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The Role of the Amateur in Scientific Discovery

The history of science bulges with the achievements of amateurs. So striking is this phenomenon that at times it seems almost as if one of the requirements for scientific discovery is initial ignorance. Undoubtedly there are reasons for this anormality, which it may be profitable to seek.

An amateur is one who is not a professional specialist. Hence a specialist in one field usually is an amateur in all other fields of knowledge. Thus regarded, it is seen that Isaac Newton must have been an amateur in nearly all the realms of science that were enriched by his discoveries. He was a professor of mathematics at Cambridge, and he remained an amateur in every other branch of science. True it is that he made some of his most profound discoveries in his own professed specialty. His development of the infinitesimal and integral calculus was an epochal achievement. But equally true is it that he revolutionized astronomy, in which he started as an amateur and remained always an amateur. Except for an occasional peek of curiosity, Newton scanned no stars through telescopes. He was content to take the data and empirical laws of Tycho Brahe, Kepler et al, and, by their suggestive guidance, deduce the law of gravitation together with its most important sublaws. Then he turned to the realm of physics which he enriched with his discoveries in optics and acoustics. He wandered from cave to cliff in many a different scientific realm, everywhere finding new nuggets of knowledge, as amazing in their richness as in their variety. Par excellence Newton was the amateur in science, yet always out stripping his contemporary professionals.

Shall we attribute this merely to genius, that word with which we cloak our ignorance of the methods of the original thinking? Or shall we try to find the principles employed by original thinkers, and the conditions under which original thought is best conducted?

Let us consider some of the conditions that assist the original thinker. One of these clearly is an unbiased attitude, a freedom from old theories that so dominate the mind as to blind it to the truth of new theories. It is characteristic of most professional men that they become exceedingly intolerant of new theories. The longer they believe in an old theory, the more intolerant they are of a new theory that conflicts with the old. While a new, true theory has a marvelous efficacy in solving scientific enigmas, an old, false theory is equally effective in turning the mind away from correct solutions. Here, too, the history of science is replete with examples.

The amateur therefore enjoys a not mean advantage over the professional, in that he is not handcuffed to any corpses. His mind's eye moves freely and quickly over hypotheses; the new being as impartially regarded as the old. He pauses with no sense of "auld lang syne" amid well known theories, but is impressed by them only, in so far as they match and explain the facts of nature. So, new and old theories look much alike to the amateur, whereas to the professional only the old cause him to lift his glass and say: "May you live long and prosper."

Great as is the importance of having a mind not initially biased by old theories, there is a much more important advantage possessed by the amateur researcher, namely the fact that he is instinctively a researcher. If he may be called a "professional" in any sense other than the common sense of earning a livelihood by a given kind of activity, the amateur investigator is a professional researcher. He is an animated interrogation point. Why this? Why that? Why the other thing? Now this characteristic is precisely the one not yet common among men. So it follows that when an amateur who is a researcher by instinct enters any realm of science, he often finds himself almost alone as to originality. What wonder then that his work soon becomes conspicuous. He encounters, of course, the ill concealed skepticism of many professionals, who at first can see in him only the amateur. Witness Louis Agassiz's announcement that he had discovered that an ice-age had existed over Europe not many thousand years ago. Professors of geology were not slow in writing him to "stick to his fishes," piscatology being his profession. Even that great migratory mind, Humbolt, solemnly adjures him not to wander into the realm of geology. But he persisted in

wandering, until he soon had all the world wondering. He had discovered a new fact of undreamed of importance, namely that climate has changed enormously. Indeed this phenomenon is one of the most important factors in biological evolution. Had there been no ice ages there would be no man, and but few of the countless species of animals and plants that now ride this spinning top of time.

Not long before Agassiz's epochal discovery, another amateur, an English county surveyor, had made a geological discovery equally great. William Smith had noticed that fossils in different rock strata differ, and he formed the hypothesis that each formation represented a geological epoch, in which different species of animals had lived. He made the first stratigraphic map ever made, and associated each formation with its characteristic fossils. His friends dubbed him "Strata" Smith, and called him "that crank." But this professional surveyor was destined to evolutionize the science of geology which was then in its infancy.

Stepping forward a century we meet an amateur of the amateurs, a young lad in his teens, not yet decided as to a profession, Luther Burbank. We see him reading Darwin's "Origin of Species," and beginning to wonder whether a man might not be able to create a new species by artificial selection even as nature had created new species by natural selection. We see him resolve to try the impossible. He starts humbly enough by developing the Burbank potato. No horticulturalist, no professsor of biology or botany here—just a New England country-town boy; but he was soon to make the naturalists of the world admit that man at last had rivalled nature by producing an entirely new species of plant.

Willard Gibbs, professor of mathematics at Yale, did not stick to his pure mathematics, but chose to wander into the field of physics where he discovered the "Gibbs phase law" that has been such an invaluable aid to research chemists that it has been termed the philosopher's stone of modern chemistry.

Gregor Mendel, a name long forgotten but now engraved large on the portals of biology, was a monk who did not confine his thoughts to religion, but sought to discover the laws of heredity. Experimenting with flowers, by crossing different strains, he uncovered what is now known as the Mendelian law of heredity.

A large book could doubtless be filled with just such biographical paragraphs as those above, each stating concisely the scientific discovery of some amateur.

Lest it be assumed that we regard the professional expert as being irretrievably handicapped by his expert knowledge, as Henry Ford seems to think, we hasten to add that it is not his knowledge that handicaps him so much as his tendency to rest satisfied with what he knows. Supplement such a tendency with an inclination to regard original research work as being beyond their powers, and you have quite a complete explanation of the paucity of discoveries by professional men.

Two generations ago German teachers of science, particularly chemistry, began to stress training in original research. The results have been so prolific that we may well wonder why American teachers have been so slow in following German practice.

If it be argued that education is primarily designed for the man who is not an original thinker, but for the average man, then the argument assumes that most men lack an instinct for originality, which is a false premise. Original thinking differs not one whit in principle from what is regarded as unoriginal or ordinary thinking, except in degree of originality. In every case of real thinking a problem presents itself for solution, and calls for the gathering of facts, then systematic classification and inferences as to what they signify. It calls also for the memorizing of many of the facts, so that the mind will have material upon which to work; but so far removed from correct understanding of psychology are most of our teachers that they actually inveigh against loading the memory with details, than which no greater error has ever been made. Our Edisons and our Burbanks have always been walking encyclopedias, loaded to the eyes with facts. So, too, are most successful men in every walk of life. It used to be said of James J. Hill that he knew every last penny of railway transportation costs, and the why of every detail. The one time that the editor heard him lecture to an audience of business men who asked him many questions it was the general verdict that they had never heard such a demonstration of the power to remember details. Yet, in the face of innumerable cases of this sort, most teachers go on decrying the teaching of anything much except "general principles." General principles never won even a skirmish without a regiment of those privates that we are prone to belittle as "mere details."

It is by observing some slight similarity between two details of different phenomena that the kinship of the phenomena is first suspected. And it is by marshalling more details that the better known phenomenon serves to guide the investigation to a theory that explains the less well known phenomenon. Exactly the same process leads to success in solving business and professional problems. Hence it is a mistake to think that German training in research work is not the kind adapted to the needs of the average man. Our firm conviction is that it is the only kind of mental training that has much merit. And it is because certain amateurs have been trained or have trained themselves in that manner that they are able quickly to solve original problems in fields that are new to them.

Let it also be noted that it usually requires only a few weeks of intensive reading to master all the theories and facts relating directly to any limited branch of scientific knowledge, and it becomes apparent that an amateur can possess himself of more knowledge about it than most professionals have. Then if the investigator has read widely in science and has remembered much that he has read, he is equipped to attack a problem in that branch of knowledge with excellent chance of successful issue.

H. P. Gillette

An Electromagnetic Whirl Theory of the Genesis of Planets

Explaining Geological and Topographical Formations, Barometric and Climatic Changes

By HALBERT P. GILLETTE

THE genesis of the solar system, and of other planetary systems, will be outlined first. Quantitative laws of planet periods of orbital revolution and of axial rotation will be given next. It will be shown that the great magnetic whirls called sunspots have their counterparts not only in cyclonic storms on the earth, but in whirls that existed in the molten matter of our globe. By their sunspot effects 11 planets have been discovered, several of which have been predicted, and one of which, Vulcan, has even been claimed to have been seen.

These and other phenomena will be shown to be caused by electromagnetic propulsion. Hence it follows that not even gravitation itself has been a more important factor in the architecture of the universe than has been the force called electricity.

It has long been known that electric currents moving in the same direction attract one another, while those moving in opposite directions repel one another, and that under certain conditions electric currents are magnetically rotated. The present article deals mainly with rotating masses, all of which are electrified to some extent by the presence of "free" electrons, and are therefore electromagnets. These may be called electromagnetic whirls, to use a generic term.

A Basic Principle.—It was established in 1876 by Rowland that a whirling metal plate charged with static electricity acts as if an electric current were flowing in circles about the center of rotation. Later, when the electron was discovered, it was evident that whether an electron is attached to a moving mass or is itself moving independently (as along a conductor), an electric current exists, with its concomitant magnetic effects. But, curiously, these facts have been given scant consideration either in the realm of astronomy or of metereology. It is true that Hale has shown that sunspots rotate and are powerfully magnetic, but this very important discovery has remained almost isolated and unused.

The Electron.—Atoms consist partly of electrons travelling in orbits about a nucleus that may itself be nothing else than a very great number of orbital electrons packed into an exceedingly small space. Atoms release electrons, probably from the nucleus, the number released (or made "free") depending upon the kind of atom, the external radiations to which it is subjected, its temperature and the pressure upon it. The higher the temperature and the lower the pressure the greater the number of free electrons.

A Great Force.—Even among scientific men few seem to know how stupendous is electric force compared with gravitative force. The electric attraction of an electron is to its gravitational attraction as $\frac{1}{4} \times 10^{40}$ is to *1;* or the electric force is 2,500,000,000,000,000,000,000,000,000,000,000,000,000 times the gravitative force of an electron. Hence even a very few free electrons in motion may be expected to show enormous power, and they do.

It is probable that no large mass exists that is devoid of some free electrons, and consequently of some electromagnetic force.

Molten whirls, as will be shown, have been the architects that have given to our globe its general topographical form. Air whirls have caused the climatic and weather cycles that, by causing rainfall, have created the sedimentary rocks and carved both the sedimentary and the igneous uplifts into multitudinous shapes.

Were it impossible to support this whirl theory in its every ramification by quantitative facts, it would be only a suggestive hypothesis at best, but the theory is supportable by so many statistical facts that only a small percentage of them can be given in an article of moderate length. However, it is believed that the facts here given will suffice to show that this electromagnetic whirl theory of the genesis of rotating and orbital masses is sound in principle and far reaching in its applications.

Planet Genesis.—As Hale has shown, sunspots are magnetic whirls in the sun's atmosphere. Free electrons tend to move along the lines of force of a magnet, hence it is probable that ionized molecules are similarly propelled. At any rate, it is certain that along the axis of a sunspot material is ejected to great heights, and presumably some of the material thus ejected travels great distances into space, propelled by electromagnetic energy. Some of the material thus ejected would necessarily be halted in its outward flight by the counter pressure of electromagnetic force of other stellar bodies, and would thereafter pursue an orbital path.

If we regard a sunspot as a rifle shooting sundust into space, some of which dust is halted by counter radiations from another sun, three effects become inevitable: First, orbital bodies

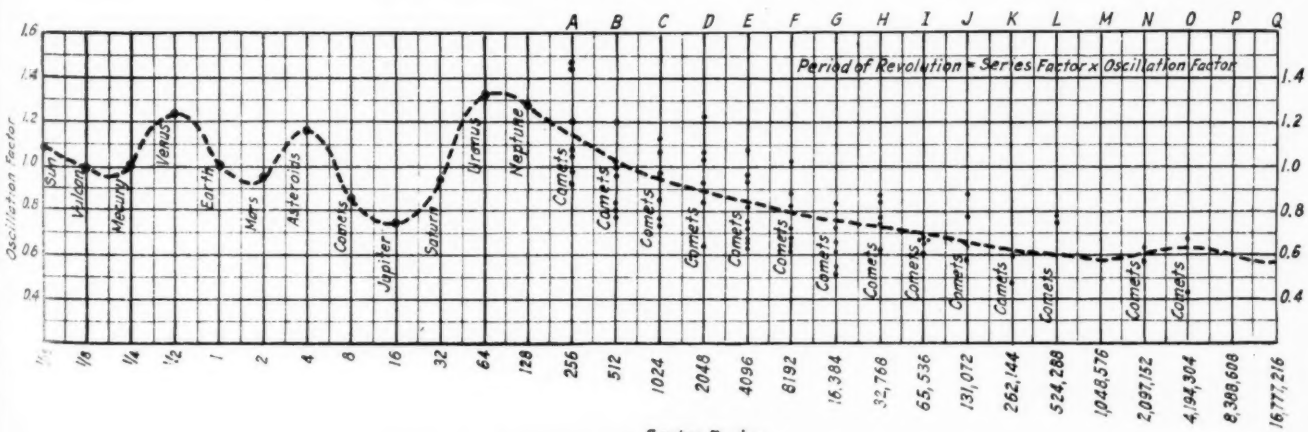


Fig. 1—Curve of Orbital Period

are created between the two suns, and those orbital bodies grow fastest that have orbital periods that are in a geometric series in which the sun's period of rotation is unity, with the orbital period of the first planet double the rotative period of the sun, and the orbital period of each successive planet double that of its predecessor. Second, the diameters of the successive planets in the series must be proportional to their mean distances from the sun, if the process of planet building is not halted, and if the rotative velocity of the generating sunspots remains constant. This means that the diameter of each planet in such a series is such that it exactly eclipses the successive planets and the distant sun. Third, as each planet becomes radiant it acts as a sun itself and halts material ejected from the sun.

Titius-Bode Law.—That some sort of a geometric series of planet distances exists was evident to Titius and Bode, who crudely expressed it in the Titius-Bode law. Unfortunately they made their doubling factor relate to distance, whereas it really relates to orbital period, so their law is but a crude first attempt at a solution of the problem, unguided by any rationalization. Study of the moons and planets shows at once the substantial truth of the geometric series of their periods and it also discloses that in some instances the multiple is 1.5 instead of 2.

The fact that our moon almost exactly eclipses the sun points to the truth of the second generalization; but even more significant is the fact that the diameters of Mercury, Earth and Saturn are very nearly proportional to their solar distances. A similar law is seen to hold approximately as to the moons of the planets.

Another Variable.—There is, however, at least one other variable to be considered, for not all the planets have diameters proportional to their solar distances, nor are their periods exactly double those of their predecessors in the series. A little consideration shows that a variable exists in the varying period of sunspot revolution about the sun's axis, the period of revolution being a function of the latitude of the spot. The empirical law that has been discovered can doubtless be rationalized, for the sunspots (being electromagnets) owe their revolution not only to the sun of which they are a part, but to the electromagnetic field of the sun which must increase in force toward the sun's poles. Likewise the migration of the sunspots to lower latitudes is a result of their propulsion by the sun's magnetic field.

Oscillation Factor.—Since sunspots are generated by planets, as will be shown, and since planets vary periodically in their sunspot effects, and since planets differ as to their respective sunspot generating power, it follows that there must have been a periodic variation both in the number of sunspots and in their average latitude. This, then, introduces what may be termed an oscillation factor that affects the period of revolution of the planets that were generated by the sundust emitted from sunspots. Study discloses that this oscillation factor also follows a geometric series law, of which more will be said later.

Periodicity Chart.—Fig. 1 shows in graphic form the law of planet periodicities, the product of the abscissa by the ordinate giving the orbital period of each planet. The abscissas are shown as a geometric series in which the multiple is 2. The orbital period of each planet divided by its abscissa gives its ordinate or oscillation factor. The curve thus found from Mercury to Neptune was extended beyond Neptune by plotting the positions of 69 comets, which are indicated by dots, and then drawing a median line from *A* to *N*. It was assumed that the points of intersection of this curve with the ordinates *A* to *N* indicate the positions of undiscovered planets on the chart, whose names are designated as *A*, *B*, *C*, etc. The chart (drawn on a larger scale) indicates that planet *A* has an orbital period of $1.14\times256=291.84$ years. It was found that Lowell had predicted a planet of about 290-year period, and that Flammarion had predicted one of 300-year period. As will be shown later, planet *A* has produced sunspot maxima every 290 years and its orbital period is 295 years.

At the beginning of the curve in Fig. 1 is shown the sun's period of rotation. Then comes Vulcan, whose period was first calculated and later found to be almost exactly in accord with certain sunspot maxima.

A Geometric Series.—Study of the curve from *A* to *K* disclosed that if the ordinate of *K* is subtracted from each of the preceding ordinates, the remainders form a geometric series in which each number is double the predecessor. Although the median curve from *A* to *K* was drawn by eye, its ordinates fit very closely the geometric series just given. When later conclusive evidence was obtained as to the existence of planets *A*, *B*, *C*, *D*, *E*, *H*, *M*, *N*, *P*, *Q*, no doubt remained as to the law of geometric series both for the ordinates and for the abscissas of the curve in Fig. 1.

The oscillation factor (or ordinate) for planets *A* to *M* is given by the formula:

$$(1)\quad f=0.56+(.05\times1.25^{n-1})$$

n is the serial number of the planet by counting backward from *M* to *A*, calling planet *L*=1, *K*=2, *J*=3, etc.

Regarding the oscillation factors of the other planets, discussion is reserved for another article.

Law of Planetary Rotation.—The heads of comets contract as they near perihelion, indicating the effect of increased electromagnetic force resulting from the liberation of more electrons under the stronger radiations from the sun. Such contraction would necessarily be accompanied by increased rotative velocity. Similiarly the embryonic planet must attain a rotative velocity that is a function of the electromagnetic forces acting upon it. Since the number of lines of electric force that a planet cuts is a function of its orbital velocity (v) and the velocity with which the generating sunspots revolve about the sun's axis, which finds measurement in the oscillation factor (f), a formula for the period of planet rotation (p) should be a function of f and v. As a matter of fact, as shown in Table IV, the following formula gives fairly close results for all the planets whose rotative periods are known:

$$(2)\quad p=2.86\, f\, v^{\frac{3}{4}}.$$

p=period of rotation, hrs.
f=oscillation factor.
v=orbital velocity, miles per sec.

Using this formula, assuming f to be constant, and introducing the law of diameter variation with distance, the Leavitt-Shapley law of absolute magnitude of the variable stars is readily deduced. This leads to the very important inference that the entire stellar system was probably generated by electromagnetic whirls, very much as the solar system was generated.

The Law of Sunspot Periodicity.—The electromagnetic whirl theory indicates that when the magnetic axis of a planet points most directly toward the sun, the greatest number of sunspots will be produced. Taking the Earth as a typical planet, it undoubtedly has two major magnetic axes: First, the one due to the rotation of the earth on its axis; and, second, the one due to the westward air current at altitudes of 20 miles and more. At high altitudes there is an eastward moving shell of highly ionized air that encircles the globe. It creates two whirls, one centering near the south pole, which is an ascending or cyclonic whirl, and one centering near the north pole which is a descending or anticyclonic whirl. This upper current of negatively charged air generates the upper magnetic field whose poles are slowly rotating westward around the axial poles of the globe. A similar magnetic field doubtless exists in the sun's upper atmosphere, for Hale has discovered that the sun's magnetic axis is also inclined and that its poles are slowly rotating. Since the number of free electrons is an inverse function of pressure, the ionization of the air increases rapidly with altitude. Consequently the electromagnetic field caused by the giant air-whirl must be very powerful. If we assume that these two magnetic axes do not coincide, and that the poles of the giant air-whirl rotate slowly westward, then it becomes evident that the maximum number of sunspots caused by the Earth will occur at intervals of less than 12 mos. By studying a curve of daily sunspots the writer found a sunspot period of 10.76 mos., which was provisionally assigned to the Earth. The well known so-called 11 yr.

sunspot period was assigned to Jupiter. It was found to be 11.207 yrs., whereas Jupiter's orbital period is 11.86 yrs. Similarly sunspot cycles were found and assigned to each of the other planets. Before the task was completed it became evident that the spread between a planet's period of revolution and the sunspot period assigned to the planet is greater the greater its orbital velocity. This led to the discovery that the following formula fits very closely the sunspot period assigned to each planet:

(3) $t=T\ (1-0.007\ v)$.

t=sunspot period due to a planet.
T=orbital period of the planet.
v=orbital velocity, miles per sec.

Table I shows how closely this formula fits the facts.

The Effect of Mars.—Study of the maximum number of sunspots corresponding to the different planets disclosed that Mars, although much smaller and farther from the sun than Venus and Earth, produces more sunspots. But this is what the electromagnetic theory might lead us to expect, for the axis of Mars is much more inclined than theirs, and therefore points more directly toward the sun. Axial inclination also explains why both Uranus and Neptune produce greater sunspot effects than Jupiter. Neptune's effects are about the same as those of Uranus; and Saturn's effects are much smaller, which is to be expected because its axis is but slightly inclined.

Since the Earth has two great magnetic fields, their combined effects are greater at intervals longer than 10.76 mos. The same is true of other planets, but this is a detail that need not be discussed now.

Table II shows the sunspot period assigned to each planet, and one of its relatively recent peak periods.

Table III shows sunspot peak years since 1615 A. D., and the peak periods of Jupiter, Uranus and Neptune. Planet *A* caused the sunspot peak of 1778; planet *B* caused the peak of 1847.

The writer has located the effects of more than a score of comets. Schuster's three sunspot periods of 4.8, 8.4 and 13.5 yrs. are assignable to the comets of 1819 IV (Nov. 20), 1889 VI (Nov. 29) and 1885 IV (Sept. 11).

Sunspot Cycles and Tree Growth.—Douglass was the first to demonstrate that the 11-yr. sunspot cycle frequently causes a corresponding cycle in the radial growth of trees. Huntington has shown that climatic changes have corresponded with a grand swing of the curve of growth of sequoia trees. Using the tabulated growth data gathered by Douglass and Huntington, the writer has been able to determine the sunspot cycles assignable to all the planets from Jupiter to Neptune. Using the same data, the cycles of planets *A*, *B* and *C* were discovered, and that of *E* was indicated. Baron de Geer's annual clay-varve chart was next used to supplement and greatly extend this investigation.

Sunspot Cycles and Clay-Varves.—The annual layers of clay deposited in ancient glacial lakes and in fiords have served, as above stated, to disclose the sunspot cycles of many planets. For 50 years Baron de Geer has been measuring and counting these clay-varves until he has produced a varve chronology that runs back more than 18,000 yrs., constituting one of the most remarkable of scientific achievements. The 11-yr. sunspot cycle is to be seen repeatedly in his charts. The writer has found many other cycles, and by their aid has been able to ascertain the date of de Geer's "zero year." The method of fixing its date was as follows:

The sunspot period of Uranus is 81.15 and that of Neptune is 161.57 yrs. Two of Uranus' cycles differ from one of Neptune's by 0.73 yrs. Since their last sunspot peaks were in 1837 and 1870, or 33 yrs. apart, it follows that they would occur together in $33\div0.73=45$ cycles of Neptune back from the year 1837. On the clay-varve chart there is a Uranus peak at —1185 and a Neptune peak at —1173, or 12 years apart. Adding the 12 to the 33

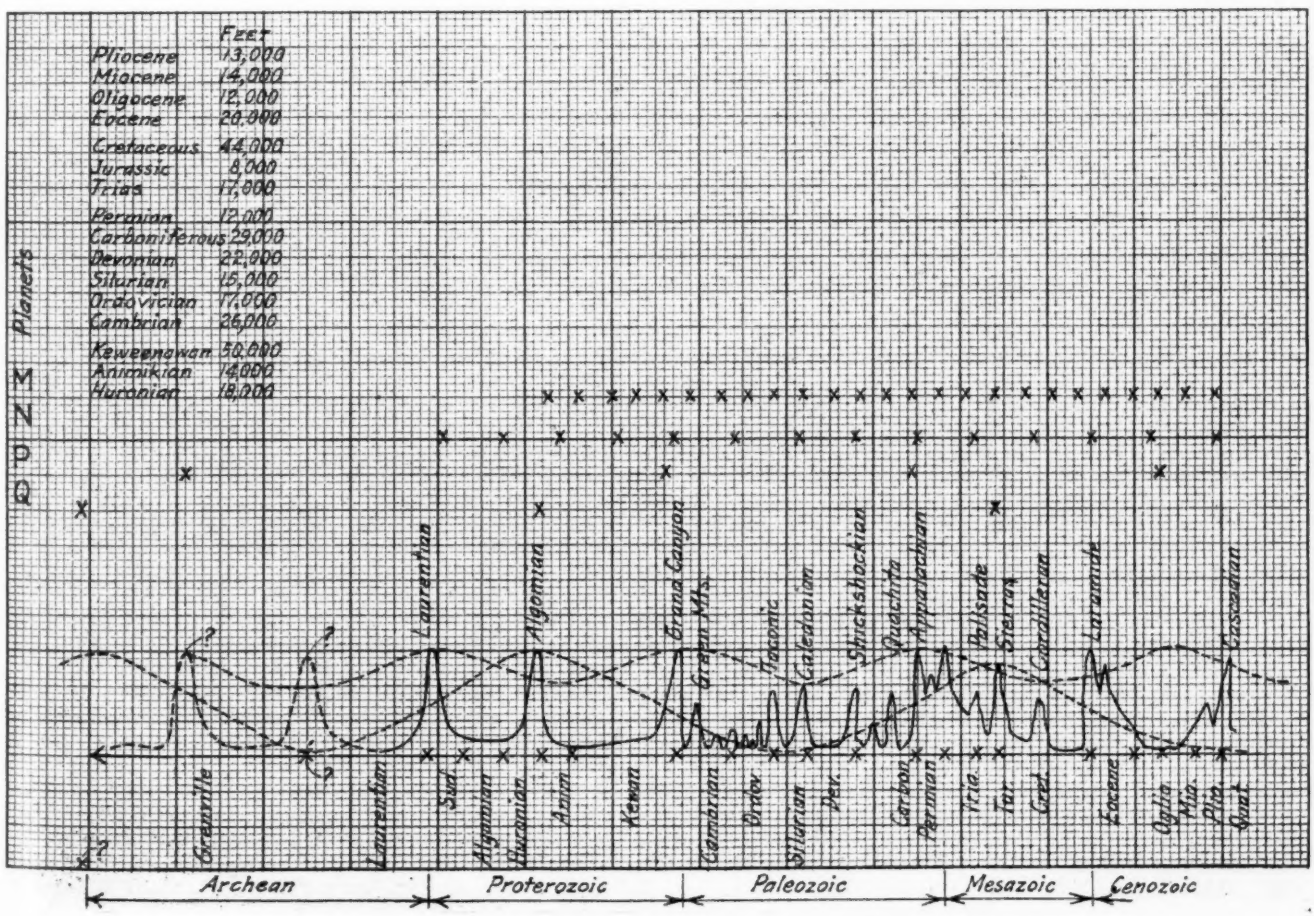


Fig. 2.—Eras, Periods and Upheavals and the Cycles of Planets M, N, P, and Q

yrs. we have 45, which divided by 0.73 gives 61, which is the number of Neptune cycles back at the year 1837 to the year —1173; hence 61×161.57= 9856, thus making de Geer's year —1173 to be 9856—1837=8019 B. C., whence de Geer's zero year is 8019—1173= 6846 B. C. There was a recent gap in the clay-varve series that de Geer had been compelled to estimate, and he had estimated that his zero year was about 6800 B. C., which he believed was within one or two centuries of the correct date. It will be seen that he missed it by only 46 years.

Using the sunspot period of planet *A*, which is 289.97 yrs., the writer secured the very same date for de Geer's zero year, namely, 6846 B. C., so there is no doubt as to its correctness.

The method of "triangulating" backward in the time scale, can doubtless be used to determine the exact age of any series of clay-varves, no matter how ancient. Since clay-varves exist at the beginning of the Huronian period, it will be feasible to carry an accurate chronology back for fully 15,000,000 yrs. of geological history.

Sunspot Cycles and Geological Strata.—Noting the frequent recurrence of a thickness of sedimentary rock of about 12,000 to 15,000 ft. in different geological periods, the writer inferred that the length of those periods might have been determined by a planet of very long orbital period. Starting with this clue, it was comparatively easy to develop a theory of stratification that fits the facts remarkably well. In very brief outline, it is as follows:

Fig. 2 is a chart reduced to one-quarter the scale of the original chart, and therefore not as satisfactory for purposes of proof; but the reader can readily plot a chart to a larger scale. In the chart the tabulated strata thickness of 16 periods is taken from Brooks' "Climate Through the Ages," p. 423. It will be noted that 6 of the 16 periods have a thickness that approximates 13,000 ft. Reed (The Varved Clays at Little Ferry, N. J.) states that the 2,500 annual clay-varves measured by him at Little Ferry have an average thickness of about 3/16 in., although the range is 1/16 to 1 in. Based on this average a foot of clay indicates 64 yrs. While there is a wide range of clay deposited between extreme years, it may be assumed that for a grand cycle of, say, half a million years, there would be a rather constant rate of erosion over great areas. Since the total thickness of sedimentary rock deposited in any geological period constitutes an integration of innumerable oscillations in rainfall, slope, temperature, etc., it is a fair presumption that such thicknesses form the best criteria of the time involved in the deposition of the strata. And until the recent use of the uranium-lead formula, this was the commonly accepted criterion, modified only by the use of "judgment." The uranium-lead formula gives results so widely differing from all others that it is open to the gravest doubt. Moreover it starts with assumptions that are unsupported by any facts.

Rate of Formation.—As a first approximation, if we assume that each foot of rock represents about 60 yrs. when taken over an entire period, we find that for a layer 13,000 ft. thick it gives a period of 780,000 yrs. The planet nearest to this period is planet *M* (Fig. 1) with an orbital period of about 587,000 yrs., its sunspot period being but very slightly (0.15 per cent) less, according to Eq. 3.

Since the Animikian period has strata thickness totaling 14,000 ft., which is just the same as that of the Pliocene, and since there are 286,000 ft. of rock between the beginnings of those two periods we have 21 cycles of planet M, each measured by 12,860 ft. of rock. But 586,000÷12,860=45.57 ft. of rock per annum. This was the second approximation in the problem of determining the chronology of the geological periods. Upon plotting this distance on a chart to a scale 4 times that of Fig. 2, and after locating the effects of another planet, *N*, in similar fashion, the value of planet *M* was slightly modified, making it 12,880 ft. of rock covering a period of 586,000 yrs., or 45.6 yrs. per ft. of rock.

Incidentally this time scale is about half as long per foot of rock as one that has been used by many geologists who have based sedimentary rock ages on present rates of erosion. But de Geer proved conclusively, by his clay-varves, that the age of the Niagara Falls gorge is only 40 per cent of the shortest age assigned to it by present rates of erosion, so our results are in general accord with his as to the lesser rate of present-day erosion. It should be remembered that the average slope of the ground surfaces was undoubtedly greater than at present, and that even a slight increase in slope greatly accelerates the velocity and erosive power of water.

The small crosses on the chart, Fig. 2, opposite planets *M* and *N*, indicate the dates of the peak affects of those planets on sunspots and on rainfall. The writer infers that even in the case of snowfall, during ice-age periods, the greatest erosion followed the winters of greatest snowfall.

The periods of planets *P* and *Q* (Fig. 2 and Table II) were determined by the periods of great continental uplifts. The Cascadian period occurs in a valley of the sunspot curve caused by planet *Q*, but the same is true of the Taconic and Caledonian uplifts. This anomaly is explained by the fact that the polarity of sunspots often changes at about the time of a sunspot minimum. A change in sunspot polarity produces corresponding changes on the earth.

The planet *M* has an orbital perio of 587,000 yrs., which is only 19 pe cent in excess of the 494,000 yr. peric of a planet whose existence Pickerin predicted. Pickering's method consist in finding the "mean argument" of aphelia of a group of planets (Annua of Astr. Obs. of Harvard, Vol. 61, p. 166, yr. 1911). Pickering predicted a planet of 26,000-yr. period, which corresponds roughly with that of planet *H* (22,180 yrs.) and he predicted a planet of 13,038-yr. period, which corresponds roughly with that of planet *G* (11,600 yrs.). He made several other predictions, and all but the first one just named range from 10 to 30 per cent above the true periods. This indicates that most of the comets have lost velocity since they were generated.

Fourteen Giant Whirls on the Earth.—Sunspots have minor maxima once every rotation of the sun on its axis, or an average of about every 27.2 days as viewed from the earth. Also a daily sunspot curve shows other periods of about ⅛, ¼ and ½ of 27.2 days. This indicates that sunspots are more numerous along certain meridians. This phenomenon resembles the geometric figures that small floating magnets form under the influence of a powerful magnetic field. Hence sunspots, which are magnets, probably tend to assume a geometric grouping, under the influence of the sun's magnetic field and their own fields. Incidentally this may explain the arrangement of the "centers" on Mars from which the "canals" radiate to other "centers"; also the grouping of "craters" on our moon.

Such geometric groups led to a search for similar groupings of whirls in our atmosphere, several of which were quickly found on charts of the movements of clouds at elevations of 5 to 7 miles. When the centers of those whirls were plotted on a large map, it became apparent that they were also centers of similar whirls that had existed in the molten matter of the earth. Fourteen such centers were located, one about 8 deg. from each of the poles, six near the equator (three in each hemisphere), three near the arctic and three near the antarctic circles. Table V gives the approximate latitude and longitude of the center of 12 of these giant whirls, and their direction of rotation.

These 14 giant cyclonic air whirls ascend to levels somewhat above the level of the cumulus clouds, and there bend over, descending as anticyclonic whirls. These 14 anticyclonic centers at the earth's surface lie to the west of the corresponding cyclonic centers and in much higher latitudes. There is a periodic shifting of these 14 anticyclonic centers, the shift being to higher latitudes at times of greater relative intensity of sunspots of south polarity.

A study of the topography around each of these 14 centers at once reveals the fact that although the centers have remained practically stationary since the dawn of geological time, the whirls about these centers have varied in diameter, and that the whirls have been annular belts that were relatively narrow, belts of land elevation alternating with belts of depression.

What the Map Shows.—Only one map, Fig. 3, is here given to illustrate these whirls; and it is not the best map for the purpose of showing the truly remarkably circular topographical features of the globe. If the reader will locate center *A* near Timbuktu, Africa, he will find that the north western coast of Africa lies on a circle about that center for half the diameter of the circle. Similarly as to north western coast of South America about center *D*. Similarly as to the south eastern coast of Australia about center *E*. Another center, *B*, is noteworthy for the remarkable circular chain of islands (Sumatra, Java, etc.) about it; center *B* is in the Philippine Islands.

Although maps having the meridians drawn in straight lines, that converge toward the poles, serve fairly well for study of these 14 giant whirls, an 8-in. globe will be found much more satisfactory.

Fig. 3 shows two whirl centers, *a* and *b*, about which whirls *a1* to *a5* and *b1* to *b6* have been drawn. Other whirls about centers *A* and *D* are shown. Whirl *A2*, for example, marks the backbone of the Rocky Mountains. About midway between whirls *a1* and *a2* lie the Alleghenies and the Appalachian Mountains. Contrast those two whirls of land elevation with the great whirl of depression, *b3*, which sweeps through the Great Lakes and the string of large lakes in Canada. This same whirl of depression passes through the centers of the Mediterranean and the Black Seas.

Even relatively small depressions (or elevations) frequently lie in series on these giant whirls. Note, for example, San Francisco Bay, Great Salt Lake, and Lake of the Woods, all on whirl *a3*.

Where two whirls of elevation intersect, an exceptionally great elevation frequently occurs; and a similar strengthening of effect often occurs where two whirls of depression intersect. This indicates that like whirls reinforce one another, whereas unlike whirls tend to nullify one another.

An Effect of the Planets.—It is evident that the belts of whirling molten matter rose or fell, depending upon their polarity, that is the direction of rotation, acting under the influence of the electromagnetism of the earth itself, of the giant air whirl whose axis terminates near the poles and of the sunspots and sun. That these giant whirls vary in intensity, and therefore in diameter, under the influence of sunspots, is hardly to be doubted. If then

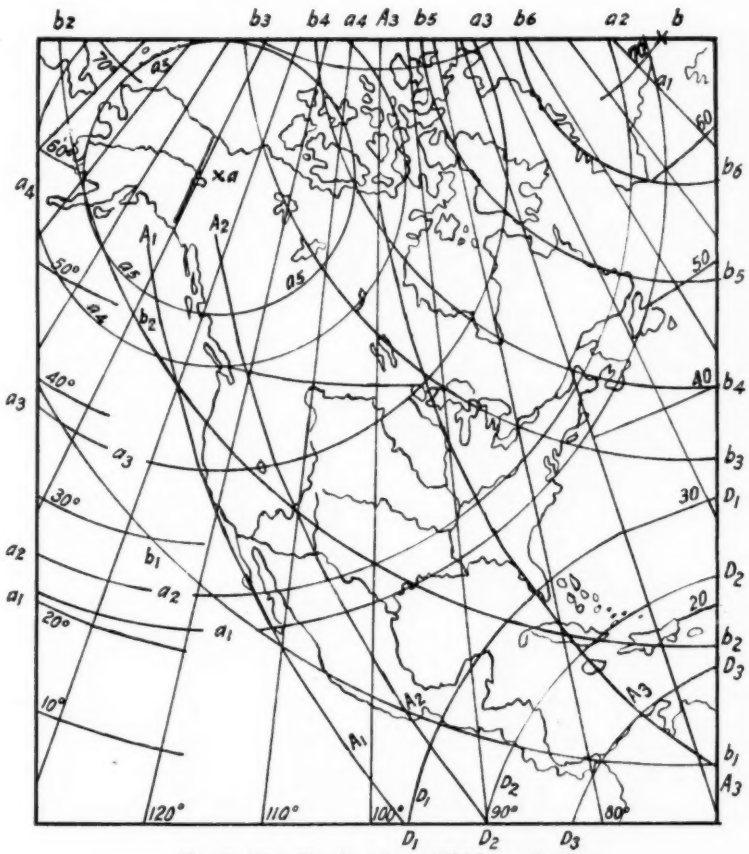


Fig. 3—Map Showing Great Whirls on Earth

the sunspots come in cycles caused by the planets, it follows that the great planets *M*, *N*, *P* and *Q* have been the cause of repeated periodic rise and fall of land along certain belts of the earth. Incidentally this explains the great outflows of lava at about the beginning of geological periods and eras. It also explains the relative permanence of the elevated and depressed regions.

Since the giant whirl whose axis lies near the poles, has opposite polarity at the two poles, we should expect to find a general elevation of land at one end and a depression at the other. This is exactly what we find—a great antarctic continent and a great arctic sea. Incidentally the exceptionally low barometer (an inch below average) that exists within the arctic circle finds complete explanation by the electromagnetic whirl theory. Many other barometric riddles are readily answered by this theory, but space forbids discussion of them now.

The Earth's Interior.—Although most geologists have abandoned the old theory that the interior of the earth is still molten, it seems to the writer that the old theory is sound. Otherwise a change of land elevation of 1,000 ft. since the last ice age (only 8,800 yrs. ago, according to de Geer's unimpeachable clay-varves) is not explainable on any hypothesis that fits well with other established facts. Incidentally it was not relief from the weight of the ice cap, but electromagnetic propulsion that caused these land elevation changes. In fact it is the very same electromagnetic motion of the fluid interior that probably explains the well known periodicity of earthquakes and volcanic eruptions. Even the small 11-yr. effect of Jupiter's sunspots has a marked relation to earthquake frequency.

Numerous Other Whirls on the Globe.—Since the lunar "craters" are probably solidified electromagnetic whirls of molten matter, and since there are a great many of them, it is a natural inference that numerous whirls existed in the molten earth. Even casual inspection discloses many. One evidently caused the Lesser Antilles, and two others not far away produced the reversed curve that forms the Isthmus of Panama. The Florida Keys were similarly formed, and so was the Gulf of Mexico from New Orleans to Yucatan. The Alaska Peninsula and the Aleutian Islands lie on the arc of a circle; so do Cape Horn and the Falkland Islands.

The iron deposits of the Great Lakes lie mostly along circles whose center is about 50 miles west of Milwaukee. One of these same whirls outlines also the western edge of the Illinois coal field. It is noteworthy that five of the six main coal fields of Texas lie close to a circle whose center is the same one that was above referred to as the center of the Gulf of Mexico. Both contours and mineral zones are so frequently found to lie along circles that

Table I—Theoretical and Actual Sunspot Cycles Attributable to 8 Planets

	Cycle		Per cent
	Theoretical	Actual	Difference
Mercury	69.65 days	68.64 days	+1.5
Venus	190.7 days	201.5 days	—5.0
Earth	10.44 mos.	10.76 mos.	—3.1
Mars	20.21 mos.	19.50 mos.	+3.5
Jupiter	11.19 yrs.	11.21 yrs.	—0.2
Saturn	28.24 yrs.	27.72 yrs.	+1.9
Uranus	81.35 yrs.	81.15 yrs.	+0.3
Neptune	160.97 yrs.	161.57 yrs.	—0.4

Note: The "theoretical period" was deduced by the formula t=T (1—.007 v), in which t= sunspot period, T=orbital period, v=orbital velocity in miles per sec.

this part of the theory discloses strong prospect of its immediate application in the search for coal, oil, iron ore, etc.

The ocean "deeps" were probably whirls of depression, and their resemblance to the circular "oceans" on the moon is thus explained. The "craters" on the moon were probably small whirls of molten matter.

Sunspots and the Magnetic Needle.—Since there are probably several powerful magnetic whirls in the earth, if it is still fluid inside, we should expect to find a rather complex behavior of the magnetic needle, which is the case. The astronomer Halley inferred the existence of two north and two south poles, and he explained them by an hypothesis of two rotating magnetic spherical shells within the earth. Like many another rejected theory, it may be revived and found to be useful. We have only to substitute a "shell" of highly ionized air for one of his earth "shells," to see that Halley's hypothesis may be essentially correct. If we add thereto some of the 12 other giant whirls, and probably some of the smaller whirls, it should be feasible to derive a very complete theory of earth magnetism in so far as it affects the magnetic needle. Even such variations as those that occur daily seem to fall into line with the theory; for the rays of the sun, particularly ultra-violet rays, ionize the air, and thus produce daily variations in the intensity of the electro-magnetism.

Whether the sunspots act directly on the earth, or indirectly through the change in ultra-violet radiation, it is certain that the magnetic needle shows periodicities corresponding with sunspot periodicities. The same holds true as to radio receptivity.

Sunspots and Weather.—No one can read carefully even a small part of the literature on sunspots without seeing that weather is, at least to some extent, influenced by sunspots. However, there are so many exceptions to the rule that rainfall varies with sunspot activity that not a few investigators doubt whether prognostications of weather, based upon sunspot activity, can ever become trustworthy. Remembering that if even but one physical variable remains unknown, no universally applicable law is likely to be discovered, an investigator should hesitate in predicting the impossibility of long distance weather forecasts. That there have been several unsuspected variables in this problem is evident from what has preceded. For example, it now appears that there are 14 giant whirls on the earth, and that their size is variable and that the direction of whirl of some of them may change periodically. This explains why sunspots may cause cyclonic storms in one belt of the earth, while at the same time causing dry weather in a nearby belt. It also explains the migration of certain storm belts to higher latitudes during periods of sunspot peaks.

Hale discovered that sunspots usually travel in pairs, and are of opposite polarity. Also he found that the leaders of the pairs are the most powerful, and that the leaders are usually of opposite polarity in the two hemispheres, yet only one meteorologist, Father Jerome S. Ricard, has put this fact to practical use, so far as the writer knows.

Polarity of Sunspots.—The writer finds that it is not the number of sunspots that determines the amount of rainfall, but that it is the preponderance of sunspots of one polarity over those of the opposite polarity, the preponderant polarity rotating in the same direction as the rotation of the cyclonic storms on the earth. This fact, taken with Hale's discovery of periodic reversal of polarities (i. e., direction of rotation), explains many of the anomalies of weather. Similarly it explains such anomalies of climate as were mentioned when discussing planet *Q*.

Of course the number of sunspots is only a rough measure of their magnetic effects, so that future investigations will be needed to determine the functional relation between number of spots and magnetic effects on the earth. In addition to which there is still another factor that the writer has not seen mentioned, namely, the direction of the axis of a sunspot relative to the earth.

Sunspots of south-polarity cause a liberation of electrons and a consequently increased electrification of the air. This increases the intensity of all cyclonic air whirls, with consequent lowering of barometric pressure and increased rainfall within the cyclonic areas. That the sunspots of south polarity rotate clockwise is indicated by the fact that when the south pole of the sun points most nearly toward the earth (Mar. 8) there is an increase of atmospheric electrification on the earth, and since the sun rotates clockwise when viewed from the south (anti-clockwise when viewed from the north), it follows from the electromagnetic theory, that a clockwise rotation causes greater electrification of the air. Since barometric pressure falls where such electrification increases, it follows that cyclonic activity increases and is the cause of the reduced air pressure. With reduced cyclonic activity the 14 giant anticyclones associated with the 14 giant cyclones subside in intensity, and rain storms then become more prevalent in the 14 anticyclonic areas.

The leader of a pair of bipolar sunspots is the cyclonic sunspot, and is the more powerful of the two in its electromagnetic effect. Hence in speaking of the polarity of sunspots, it is the polarity of the leaders that is commonly meant. At the present time (1928) the sunspots in the southern hemisphere have a south polarity and an inferred clockwise rotation. This will continue until about 1933 when the new cycle of southern sunspots will begin to have a north-polarity, according to Hale's law of reversal of polarity.

The relative number of sunspots in the sun's two hemispheres changes periodically. The writer has found that these periods are determined by the positions of the more powerfully magnetic planets, notably Neptune and Uranus, with reference to the plane of the sun's equator. When Neptune, for example, is north of the sun's equatorial plane, then it generates more sunspots in the sun's southern hemisphere than in its northern hemisphere. In general, a planet generates the most sunspots on the area of the sun most remote from the planet. Combining this principle with that of Hale relative to the periodic reversal of sunspot polarity, it becomes feasible to ascertain the periods during which the maximum electrification and minimum barometric pressure are produced in the earth's air.

There has long been observed a tendency for a 5.6 yr. rainfall cycle to occur in areas where the 11.2 cycle occurs. This is now explanable. At

Table II—Sunspot Cycles Attributable to 19 Planets

Planet	Series Number	Length of Cycle	Date of Sunspot Peak
Vulcan	1	29.49 days	Nov. 25, 1927
Mercury	2	68.64 days	Aug. 18, 1927
Venus	3	201.5 days	May 25, 1927
Earth	4	10.76 mos.	Sept. 15, 1927
Mars	5	19.50 mos	Jan. 18, 1927
Jupiter	8	11.21 yrs.	Aug. 12, 1917
Saturn	9	27.72 yrs.	Aug. 30, 1924
Uranus	10	81.15 yrs.	July, 1870
Neptune	11	161.57 yrs.	Jan., 1837
A	12	289.97 yrs.	May, 1778
B	13	512 yrs.	Oct., 1847
C	14	951 yrs.	1019
D	15	1,835 yrs.	1356
E	16	3,213 yrs.	420 B. C.
H	19	22,180 yrs.	7,919 B. C.
M	24	586,000 yrs.	293,000 B. C.
N	25	1,278,000 yrs.	521,000 B. C.
P	27	5,113,000 yrs.	1,524,000 B. C.
Q	28	9,390,000 yrs.	5,355,000 B. C.

Table III—Dates of 28 Sunspot Maxima and the Sunspot Periods of 3 Planets

Actual Sunspot Peak	Smoothed Curve Peak	Jupiter Period (11.21 yr.)	Uranus Period (81.15 yr.)	Neptune Period (161.57 yr.)
Year	Year	Year	Year	Year
1615		1614.9		
1626		1626.1	1627.9	
1639		1637.4		
1649		1648.6		
1660		1659.8		
1675		1671.0		1675.5
1685		1682.2		
1693		1693.4		
1705		1704.6	1709.1	
1718.2		1715.8		
1727.5		1727.0		
1738.7		1738.2		
1749.9	1750.3	1749.5		
1761.4	1761.5	1760.7		
1769.7	1769.7	1771.9		
1778.4	1778.4	1783.1		
1787.9	1788.1	1794.3	1789.3	
1804.9	1805.2	1805.5		
1817.3	1816.4	1816.7		
1830.3	1829.9	1827.9		
1836.9	1837.2	1839.1		1837.1
1847.8	1848.1	1850.3		
1860.5	1860.1	1861.6		
1870.4	1870.6	1872.8	1870.5	
1882.3	1883.9	1884.0		
1893.6	1894.1	1895.2		
1907.2	1906.4	1906.4		
1917.6	1917.6	1917.6		
	1928.8(?)	1928.8		
	1940.0(?)	1940.0		
	1951.7(?)	1951.2	1951.7	

Note: Daily sunspot numbers are available since 1748, also monthly and yearly averages. Prior to that only the years of maximum and minimum sunspot numbers are available, and those back only to 1610.

such intermediate periods of increased rainfall during a minimum number of sunspots, sunspots of south-polarity predominate in marked degree over those of north-polarity.

Failure to realize that sunspots of south-polarity are the cause of barometric lows, has been at the bottom of much of the confusion relative to the relation between sunspots and weather. Coupled with confusion on this matter has been the confusion arising from failure to see that there are 14 giant non-migratory cyclones with their consequent 14 anticyclones.

As will be indicated later, the axis of a sunspot ordinarily is not radial with the sun, but it points backward in the leading sunspot of a pair, and forward in the following sunspot. This explains why sunspots produce their greatest effects when near the edges of the sun. It explains several other phenomena of a "lagging" nature.

U-Shaped Whirls.—Any whirling gas or liquid that is also advancing tends to bend. If it bends backward sufficiently an ascending cyclone descends as an anticyclone, forming an inverted U. Then if it breaks at the bend, there appears to be two independent whirls turning in opposite directions. This is the writer's explanation of the pairs of sunspots of opposite polarity. The alternation of low and high barometric centers that travel across any continent from west to east are similarly explainable. They are not only rotated electrically but propelled electrically eastward and toward the equator, as are sunspots. Incidentally, Clayton's law of cyclonic storm migration finds explanation by this theory. The more powerful leader of a pair, the cyclone, tows the anticyclone after it.

Table IV—Axial Rotation Periods of 6 Planets, Actual and by Formula $p=2.86fv^{3/4}$

	v	f	p, hrs.	Actual, hrs.	Difference
Earth	18.52	1.00	25.4	24.0	+ 6%
Mars	15.00	0.94	20.6	26.6	—22
Jupiter	8.12	0.74	10.2	9.9	+ 3
Saturn	6.00	0.92	10.1	10.2	— 1
Uranus	4.24	1.31	11.1	10.8	+ 3
Neptune	3.40	1.27	9.1	7.8	+16

In a whirl belt or zone of rising air, such as one of the 14 giants above named, there develop small whirls, which ascend and bend over. The rising warm air tends to lose its moisture by precipitation; and, becoming cold, descends as dry air in an anticyclone. It is this descent of anticyclonic air that explains the lowering of temperature in storm belts. Where the cyclones and anticyclones are made sufficiently large and strong by intense sunspot activity, an ice-age develops. This explains the coincidence of ice-ages and great land upheavals, for both are the effects of a common cause.

Ocean Currents.—The electromagnetic whirl theory explains ocean currents better than does the prevalent theory that they are the effects of winds. While it is true that winds and ocean currents have much in common as to their general motion, study discloses many motions that differ to such an extent that the wind hypothesis of ocean propulsion seems to be insufficient. Let ocean currents be studied with respect to the 14 whirl centers, and they will be seen to find better explanation.

Convection Currents Inadequate.—Although meteorologists have usually regarded weather changes as being almost completely explainable as due to heat differences, there has been accumulating a mass of facts that have not found explanation in the convection theory. Huntington has stressed the fact that climatic changes are kin to weather changes. He has suggested the possibility of electric forces as causes of weather and climatic changes. But having only one fairly well established sunspot cycle, namely, the so-called 11-yr. cycle, and with no established theory of the cause even of that one cycle, it was not feasible for him to carry his hypothesis far. However, his books were of great help to the writer, for they contain many facts and relations between facts that became highly significant once a definite hypothesis had been framed. The same is true of many of the facts in Clayton's "World Weather" and in Brooks' "Climate Through the Ages."

Huntington's great conception of climatic changes as results of stellar influence was not correct in that he had in mind stars instead of planets. Yet such rational gropings after truth often are extremely suggestive guides to men who come later in search of the cause of things. All creative thinking is of that type. The slightest likeness between two phenomena may be the first clue to a great kinship.

Table V—Locations of the Centers of 12 Giant Whirls

Whirl Center	Latitude, Degs.	Longitude, Degs.	Direction of Whirl
A	18 N	4 W	Clockwise
a	64 N	136 W	Clockwise
B	16 N	121 E	Clockwise
b	68 N	22 W	Clockwise
C	8 N	180 W	Clockwise
c	64 N	76 E	Clockwise
D	2 S	67 W	Anti-clockwise
d	69 S	174 W	Anti-clockwise
E	29 S	144 E	Anti-clockwise
e	69 S	30 W	Anti-clockwise
F	9 S	140 W	Anti-clockwise
f	70 S	68 E	Anti-clockwise

The writer does not agree with those who insist upon complete proof of a theory before publication. Had Fitzgerald not suggested the hypothesis that matter contracts in the direction of its motion, Lorentz would never have deduced the contraction of electrons; and had this deduction not been made, there would have been no Einstein theory of relativity. After even one such episode in scientific history, no one should attempt to weigh the value of any embryonic scientific hypothesis, and find it worthless merely because it is but an embryo.

Sunspots, Ice Ages and Evolution.—When Agassiz published his ice-age theory, Humboldt wrote to him saying: "Agassiz, you should stick to your fishes." Fortunately for geology Agassiz did not stick to his fishes, nor William Smith to his surveying compass, nor Hutton to his pills. The secrets of nature are not infrequently more evident to the amateur than to the expert; for the expert's eyes are often diverted from the truth by a long accepted theory that is false. False theory is as misleading as true theory is enlightening.

From the electromagnetic theory it is to be inferred that ice-ages have marked the apex of every geological era. It is no mere chance that each great ice-age has ushered in a host of new species, and has wiped an older host off the slate. The new living conditions caused by such great climatic changes have killed off those species that either could not accommodate themselves quickly enough or could not migrate far enough. Enforced migration, during the ice-ages, has led to the crossing of different strains of the same species which, as Burbank discovered, results in many extreme departures from type. This greatly accelerates evolution.

Man himself would still be unevolved were it not for ice-ages, and therefore for sunspot cycles, and therefore for planets as yet unseen. Although unseen, many planets make themselves evident by effects that are visible, just as is the case with atoms and electrons.

Planet *E*, whose sunspot period is 3,213 yr., was one of the causes of the last ice-age, which reached its apex 6846 B. C. Planet *E* also caused the cold, wet period that reached its apex 420 B. C. It is alsc responsible for

the drought period, whose extreme was about half its period or 1607 yrs. later, 1187 A. D. Since then there has been an upward trend in rainfall, affected, of course, by the sunspot cycles of the lesser planets.

Planet H, whose period is about 22,000 yr., cooperated with planet E, and both were aided by the great planet Q.

Climatic Changes.—As Huntington correctly inferred, climate shows periodic changes that are merely weather changes on a greater scale, both of intensity and duration. We may therefore expect ice-ages to come again, and, with their coming, to affect life on the earth as profoundly in the future as it has been affected in the past. But by study of past effects, guided by a correct theory, man will be able to forecast accurately the next ice-age, and thus will be able to prepare for it far in advance by moving to spots where genial climates will exist. Long before that event, electrical engineers will have learned to apply the whirl theory in countless ways, and will have discovered how to bend to man's service the vast magnetic whirls above and beneath the earth's surface. Geologists will have learned how to predict earthquakes and volcanic eruptions, and, what is vastly more important, will have discovered the laws that determine the location of mineralized belts. Astronomers will have reduced the forecasting of sunspot changes to an accuracy comparable with the forecasting of eclipses; and guided by such k n o w l e d g e, meteorologists will have attained to almost equal precision in foretelling the weather far enough in advance to guide the farmer in his crop plans and the engineer in his location and design of hydraulic works.

Bethlehem Rolling New Sections

Bethlehem Steel Company, which recently added to its line of structural shapes a series of 33-in. beams and girders, now announces the rolling within the past few weeks of a series of 36-in. wide-flange beams and girders at its Lackawanna plant, Lackawanna, N. Y. These new sections are the deepest, heaviest and strongest beam sections produced in the United States.

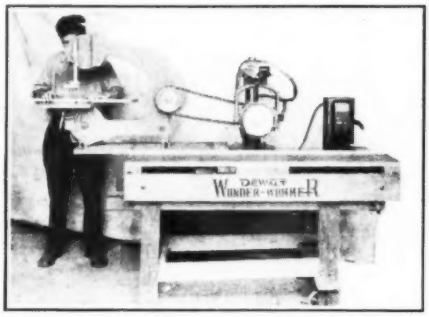
The 36-in. I-beams are rolled in weights of 147, 155, 164 and 173 lb. per ft. and the girder beams are rolled in weights of 231, 240, 250 and 260 lb. per ft.

These new sections will have especially large application in railway and highway bridges and in building construction. They are rolled on the company's patented Grey mills and a regular rolling schedule is being maintained. The company announces that the sections are now available.

New DeWalt Portable Band Saw

The DeWalt Products Company of Leola, Pa., has recently announced a new portable band saw that is said to have an unusual capacity.

The DeWalt band saw is designed to provide in a portable machine power and handling capacity of a production stationary band saw. The machine is guarded to a maximum degree. The DeWalt band saw above the floor standard is mounted in one casting housing



New Band Saw Set Up for Use With DeWalt "Wonder-Worker" Saw Rig

the three tracking pulleys and saw blade. By the simple means of one cover hinged on to the casting the blade is entirely covered, is only open at the cutting point.

The unusual feature of using three tracking pulleys instead of two large pulleys to separate the two sections of a revolving saw blade has made it possible to design a compact machine with 20-in. clearance in the throat between saw blade and frame; with capacity to handle material up to 7 in. thickness.

The entire machine, including floor standard motor, weighs only 210 lb. Without motor and floor standard it weighs 120 lb. This portable advantage does not in any way handicap it as a stationary unit. It has the power and capacity of a production machine, say the manufacturers.

This unit is preferably used as an individual motor driven unit equipped with motor and floor standard. However, the DeWalt band saw can be used independent of motor and floor standard. This unit can be mounted on a DeWalt "Wonder-Worker" so as not to interfere with any other operation of that machine. By simply attaching the pulley on the arbor of the Wonder-Worker and swinging arm to the rear the band saw is ready to operate. Replace the V drive pulley of band saw with flat belt pulley and the DeWalt band saw can be driven from a line shaft.

Twelve outstanding principals incorporated in the design of the DeWalt Band Saw are:

Twenty-inch throat clearance; compact roller saw guide, adjustable to handle material 7 in. thick; three aluminum ball bearing mounted pulleys; completely covered saw track and pulley, with only 8 in. of saw surface exposed and that only at the cutting point; working table 13⅝ in. square; dial indicator in degrees measures the work, table tilts 45 deg. to the right and 30 deg. to the left; table stop to quickly bring table to exact horizontal position; tracking device to adjust rollers so that saw tracks are exactly over rollers; silent transmission of power by V belt to motor, pulley drive to line shaft or direct driven from DeWalt "Wonder-Worker" motor shaft; ½ hp. motor to suit proper requirements; floor standard is light in weight, rigid construction, with sheet metal base, solid and permanent; weights are as follows:

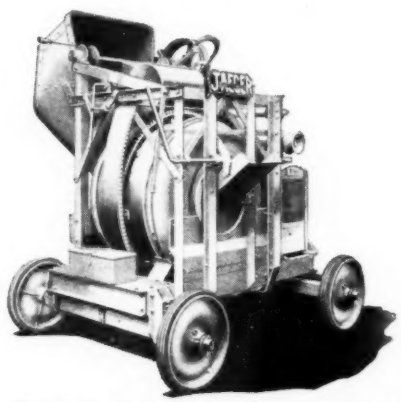
Individual motor-driven band saw complete with motor and floor stand	210 lb.
DeWalt band saw attachment	120 lb.
Floor standards	55 lb.
Motor	35 lb.

Jaeger Announces New Mixer

The "Speed Queen," a 7-S non-tilt concrete mixer, on four wheels and with a spring hung chassis, is the latest announcement of The Jaeger Machine Company, Columbus, Ohio. Its mixing time and time for charging and discharge are the same as the Speed King, a fast one bag trailer introduced by the Jaeger company a year ago.

Longer life to the mixer and saving of wear on tires, due to the new spring mounted construction, are claimed by the maker. Being built of steel the Speed Queen also combines an estimated 50 per cent extra strength with a saving of one-half ton in weight, according to the manufacturer. Rollers and countershaft are ball bearing; the steel disc wheels are roller bearing.

Price of the standard model, which is stated to be a considerable reduction under the present market, includes Automatic Skip Shaker, Accurate Measure Water Tank, 2 cyl. Le Roi engine. It is also built in low charge type.



The Speed Queen, a New Mixer Announced by Jaeger

Time Saving Methods in Billing and Collecting

Methods Developed by a Canadian Town

By W. D. STALKER

Secretary, Simcoe Public Utilities Commission, Simcoe, Ont.

THE Town of Simcoe has had the same rapid electrical growth as like Hydro municipalities in Ontario, but while substation and line had been extended and rebuilt, for ten years the office had stood still. It was thought, therefore, that the office would soon have to be enlarged and the staff increased. However, just as the regulation of loads may improve distribution conditions to such a degree as to save the installation of additional station capacity, so too in the office the correction of "office power factor" may save the employment of more "prime movers." This was tried in the office of the Simcoe Public Utilities Commission with rather remarkable results.

Office Plan.—Advantage was first taken of a general change in the municipal building to so design the billing and collecting office that the best layout for local conditions might be obtained. During the alterations a temporary arrangement for collecting proved so convenient for posting also, that the idea suggested itself of embodying the posting desks with the counter inside the wickets. The final result has not only saved steps and time for the office staff but also the public is more quickly served.

Addressograph.—It had been standard practice to make out and address all hydro and water bills by hand, using a postcard type of bill. An addressograph and graphotype were now added to the equipment and a great time saving in addressing was made immediately. Parenthetically, it may be remarked, that while at first somewhat dubious about the wisdom of purchasing a graphotype, this machine saved a considerable part of its cost by enabling the local staff to make all the originally necessary plates or stencils, as occasion presented, at small cost, and is now invaluable for changeover and new services.

Straight Line Bill.—The full advantage of the addressograph equipment was not realized, however, until the old card supply was exhausted and use of the "straight line" bills was commenced. For both electricity and water, these were designed by the Hydro Electric Power Commission Municipal Auditor, Mr. McCollum. The only continued criticism made of this straight line bill, has been by a school teacher, who objected to the number of times the word "bill" appeared. The answer is, however, that the reiteration automatically draws the bill-fold from the customer's pocket and painlessly extracts the required number of bills to pay the bill before the discount date.

Computer.—The use of a Bates Index, with ribbon for computing domestic electricity bills without figuring them, has also proved a valuable timesaver. The bills are first run through the addressograph which puts the complete address including service number, on both bill and stub at one operation. They are then typed directly from meter sheets, the amount of the bill being read off the index or computer, and the lay-out of the bill is such that all typewritten figures are in one straight line, so that no extra setting of the typewriter roller is necessary. The meter reading and amount of the bill is entered on the ledger card by hand at the same time. By taking the readings form the meter books the bills are kept in the correct rotation for subsequent delivery, saving time formerly spent sorting. The addressograph plates are of course kept in their trays in the same order as the meters are read, so that proper plates feed into addressograph automatically.

Off-Peak Time.—The address of all bills and also the dating with a rubber stamp is done ahead of time in "office-off peak" hours. This has helped flatten the monthly office load curve, and there is but a small "valley" between billing periods. Even this "depression" may be overcome by having the last discount date for electricity bills the 10th of the month and giving until the 15th for water accounts. This "staggering" has just been inaugurated, and so definite results have not yet been obtained.

Side-Opening Meter Books. — Not content with the foregoing changes, side-opening meter books were also recommended. They were accordingly purchased and have not only been approved by the meter man but have been endorsed by the office staff. The office saving is particularly noticeable in billing the domestic hydro accounts when meter books, cards, computer and typewriter are all used together.

Meter Department.—Due to the small size of the system it had previously been the custom to use a lineman for the necessary time each month reading hydro meters, and a man from the waterworks department to make their quarterly water reading. This has now been combined under one meterman, who reads all meters both electric and water, and if time permits, delivers the accounts. This arrangement has not only effected a saving in cost but is more satisfactory to all the departments. The outside electric work is not interrupted, the water work is not inconvenienced, and the office is in closer

SIMCOE PUBLIC UTILITIES COMMISSION
58 PEEL STREET, SIMCOE, ONT.

THIS BILL IS DUE WHEN RENDERED. Unpaid Bills will be Collected According to Public Utilities Act

Date	Present Reading	Previous Reading	Consumpt'n	Consumpt'n Charge	Service Charge	Gross	Net

Arrears		
Total		

This Bill is for **Two** Months From Meter Reading Date on Previous Bill, Unless Stated Otherwise Here.....Months

Installed Capacity.....Watts.

THIS BILL SUBJECT TO METER OR CLERICAL ERRORS.

Payable at Clerk's Office
58 Peel Street

Office hours:
9-12 a.m., 1-5 p.m.

For details of billing see back of bill.

SIMCOE PUBLIC UTILITIES COMMISSION
HYDRO LIGHTING SERVICE
Mail stub only when paying by cheque.
If receipt is desired, enclose postage for return

Gross	Net

Account

Last Discount Day
10th

Straight Line Bill Used for Lighting Service

SIMCOE PUBLIC UTILITIES COMMISSION
WATERWORKS DEPARTMENT

THIS BILL IS DUE WHEN RENDERED Unpaid bills will be Collected According to Public Utilities Act

Date	Present Reading	Previous Reading	Consumpt'n	Consumpt'n Charge	Meter or Flat Rate per Quarter in Advance	Gross	Net

Arrears		
Total		

This Bill is for **Three** Months from Meter Reading Date on Previous Bill, unless stated otherwise here.....Months

The consumption charge is 15 cents per 100 cu. ft.

The By-law provides that if this Account is not paid within 15 days after the date rendered, water shall be turned off until arrears and charges are paid, including an additional charge of 50 cents for turning off and on

SIMCOE PUBLIC UTILITIES COMMISSION
WATERWORKS DEPARTMENT
Mail stub only when paying by cheque.
If receipt is desired, enclose postage for return

Gross	Net

Account

Last Discount Date
15th

Straight Line Bill Used for Water Service

touch at all times with the meter department. On some routes both electric and water meters are read at the same time which has not only resulted in a time saving but has proved more satisfactory to the customers who are thus subjected to fewer calls and less change in personnel.

Results.—As these changes have taken place successively the credit due each factor has been noted and the results tabulated:

Electric—

Billing periods

Old System	54	hrs.
New System	29	"
Saving	25	"

Allotment of Saving

Office Plan	7½	hrs.
Addressograph	12	"
Straight line bill	½	"
Computers	3	"
Side-opening Meter books	½	"
	25	"

Waterworks—

Billing Periods

Old System	126	hrs.
New System	54	"
Saving	72	"

Allotment of Saving

*Office Plan	38	hrs.
Addressograph	31	"
Straight line bill	3	"
	72	"

*The large saving allotted to office plan is by reason of a more convenient arrangement of the waterworks ledgers, three ledgers being used simultaneously.

Absit Omen.—Astonishing as results have been, a continued study with a view to further time saving reveals that the limit has even yet not been reached. A better wicket lay-out, a further use of computing charts, and the installation of power driven equipment will eventually, be necessary as the increase in the municipality again loads the office to 100 per cent capacity.

Tools Needed for Sewer Maintenance

By C. V. JOYCE

In view of the great investment in sewerage systems it is only proper that a sufficient amount of money should be expended to care for these structures, keep them clean, in repair, and ready to serve their purpose at all times. When a sewer fails to perform properly there is likely to be serious complaint and severe criticism of those responsible for its operation. It costs less to make minor repairs as they become necessary than to allow them to await a more convenient time for repair. Serious damage may often be avoided if inspections are frequent and the minor repairs made promptly.

A knowledge of the general physical condition of the sewers is necessary for their proper operation. This can be had best from regular and systematic flushing and inspection. The small sewers at the upper ends of a system, and especially those having exceptionally flat grades, should be flushed and inspected once a month, or even more frequently where required by local conditions. Siphons and those sewers which accumulate large amounts of detritus should be inspected monthly. A general inspection of the entire system should be made annually along with the regular inspection of the smaller sewers. In making an inspection, defects in masonry of the manholes, breaks, stoppages and any unusual deposits in the lines should be noted. Mirrors may be used to reflect a pencil of light through the pipe between manholes. If artificial light is needed electric lamps should be used in preference to candles or kerosene lanterns in order to avoid the danger from gas explosions.

Stoppages in sewers are caused by heavy deposits, such as sand, gravel, or road detritus; lighter deposits of organic matter, grease, roots, rags, breaks in the sewer, and miscellaneous materials. Heavy deposits may be removed with a scoop or collapsible hoe attached to sewer rods, a self-propelling nozzle attached to fire hose, or by the use of a power or hand operated sewer cleaning machine with sewer buckets.

Roots find their way into sewers through defective joints, cracks and sometimes through a hole as small as that in a darning needle. Once entered they grow, branch out, and thrive. If not removed they become matted hair-like beards 2 or 3 ft. and some times 8 to 10 ft. in length. Roots are best removed by the use of a sewer cleaning machine with root cutting buckets. Two buckets suited to the size of sewer are drawn into it, one with the cutting edge down and the other with the cutting edge up. In this manner the full circumference of the pipe is rubbed with the knife edge of the buckets so that the roots are cut wherever they enter. A crew consisting of a foreman and 4 laborers operates the cleaning machine. A windlass is set up over each of two manholes. Rods, 3½ ft. in length, are pushed through the line and wire rope from one windlass is drawn through as the rods are taken from the next manhole. A cable end from each windlass is then attached to the buckets. The buckets are drawn into the sewer until they become loaded with roots and then are pulled back to be emptied. This is repeated until the buckets have passed to the next manhole. Roots soon grow back into a sewer. When they become abundant and very troublesome it is more economical to uncover the joints affected and replace them with a root resisting compound.

The following tools and equipment are essential for the operation and maintenance of the sewerage systems in small cities. A sewer cleaning machine consisting of two windlasses and a wagon frame on which to transport the windlasses should be provided. Each windlass should have about 500 ft. of 7/16-in. wire rope or an amount equivalent to the distance between manholes. One and one-quarter inch octagon hickory rods are essential. If they are 3½ ft. in length they will be found most convenient to use. Floating rods of the same size and shape, but of lighter wood, are advantageous in many instances. One inch round rods with Felton patented couplings are best for house services.

Cleaning tools used with the rods are a flat steel gouge, 4 in. wide for ordinary stoppages caused by small clumps of roots, rags, etc.; scoops, 18 in. long, made of sheet iron for small deposits of sand and gravel or mud; circular cutting tools for roots; a collapsible hoe and a claw for rags or paper. These tools are made slightly smaller than the pipe and are useful in house services. The collapsible hoe collapses when pushed ahead of the rods and opens when the rods are pulled back. It is useful in removing sand, gravel, and road detritus. Plain and toothed root cutting buckets of various sizes are used with the cleaning machine to remove deposits and roots.

A very useful tool for removing deposits of mud, sand, or gravel from sewers, and particularly from storm drains, is the self-propelling nozzle. Attached to a fire hose, it revolves, opens its way into the sand and mud and washes the deposits back down the pipe.

The elevations of manhole covers on unimproved streets must be changed to conform to new grades as the streets are improved. In this connection manholes built in the shape of a bottle neck are advantageous, as this allows the flange of the frame and cover to have a full bearing when the manholes are cut down or raised. When it is necessary to lower the cover on a manhole without the neck, the masonry must be taken out well below the new grade and the upper part of the manhole rebuilt to obtain sufficient bearing for the cover.

Acknowledgment.—From a discussion following a paper by another writer at the Second Annual Conference of the Maryland Water and Sewage Association.

New Traffic Ordinance of San Francisco Working Well.—The new traffic ordinance of San Francisco which became effective Nov. 1, 1927, is stated to be bringing excellent results. Figures show a notable reduction in the number of personal injuries and in the amount of property damage. It is estimated that a saving of $2,000,000 a year in the cost of automobile accidents is being made for the vehicle owners of San Francisco. The new ordinance is stated to have materially increased the average speed of traffic by eliminating unnecessary delays at clearance zones near intersections and by providing loading zones to eliminate double parking, by means of signal systems, and other improvements.

Court Decisions Relating to Sanitary Matters

Rulings Summarized in Public Health Report

Disposal of Garbage by City Held Governmental Function. — (Michigan Supreme Court; Curry v. City of Highland Park, et al., 219 N. W. 745; decided June 4, 1928.) In a suit for specific performance involving the sale of certain land, owned by the city of Highland Park and used principally for the disposal of the garbage of the city, the question was presented as to whether the said property was used in the discharge of a governmental function. The supreme court held that the disposal of garbage by the city was a governmental function, saying:

* * * The matter of public health is not local; it concerns the State. In matters relating to public health, the city acts as an arm of the State, and the property whose use is devoted to the public health is used in the discharge of a governmental function. * * *—Public Health Reports, Aug. 3, 1928.

City Held Liable for Water-borne Typhoid Fever.—(New York Supreme Court, Appellate Division; Wiesner v. City of Albany, 229 N. Y. S. 622; decided June 22, 1928.) An action was brought against the city of Albany to recover damages for illness caused by typhoid fever. It was claimed that the disease had its inception in unwholesome water furnished by the city, that this condition arose through the negligence of those in charge of the water system in failing to purify the water delivered to consumers, and that the authorities neglected to give warning although they had notice that dangers existed. The city water supply was taken from the Hudson River, and to purify the supply the city had a system of filtration and chlorination. After chlorination the water went into a "pure water" or "clear water" well, and from there was conducted through a conduit 8,000 ft. long to a pumping station whence it was distributed through the city mains. The conduit for the greater part of its distance was under the bed of the old Erie Canal. The walls of the conduit had become rusted and broken, so that there were holes therein, of which the city had notice and which permitted external waters to seep into the conduit. There was evidence that the waters remaining in the canal basin were polluted. On nearly every day between April 7 and 23, 1924, colon bacilli were found in increasing numbers in the city water supply, indicating some definite source of pollution not eliminated by filtration, but the city took no preventive measures until an epidemic had broken out. A jury returned a verdict for the plaintiff and the judgment thereon was affirmed by the appellate division of the supreme court. The following are excerpts from the appellate division's opinion:

* * * The officials in charge of the water department had notice of the defective condition of the conduit, the sudden pollution of the water, and of the outbreak of diseases traceable to impure water, but the warnings were ignored. It was a time for prompt and decisive action. There were two possible sources of contamination—one by impure water passing the filters into the well; the other by introduction of polluted water into the conduit. The exercise of vigilance would have led to discovery of the dangerous condition and reasonable diligence would have provided the remedy. It was possible, by greater chlorination before the water went into the clear-water well, to eliminate all dangerous bacilli which had passed the filter, and there was a chlorination plant at the Quackenbush Street pumping station which would have removed the new pollution occurring in the conduit, but this was not put in use, at least during the first 10 days in April. Common prudence would have suggested a notice to citizens that the water had become polluted, and a recommendation that all water intended for human consumption should be boiled. But no preventive measures were taken until an epidemic had broken out.

* * * * *

* * * The evidence supports and justifies the verdict that those performing duties so closely related to the public health were negligent in failing to exercise reasonable and commensurate care in providing wholesome water. * * *—Public Health Reports, Aug. 10, 1928.

City Held Liable for Nuisance Caused by Septic Tank.—(Kansas City, Mo., Court of Appeals; Newman v. City of Marceline, 6 S. W. (2d) 659; decided May 21, 1928.) An action was brought against the city of Marceline to recover damages for the maintenance of a nuisance. The plaintiff alleged that a septic tank, constructed and maintained by the city near her residence, which she owned, emitted foul and offensive odors which deprived her of the comfort and enjoyment of her home. The city's contention was that, if the septic tank was a nuisance, it was a public one, and, for that reason, it was incumbent on the plaintiff both to allege and to prove that she sustained special injuires or damages different in kind or character from those suffered by the public generally. In affirming a judgment for the plaintiff, the court of appeals said:

While the petition does not specifically allege that the injuries suffered by plaintiff were different in kind or character from those suffered by the public generally, it does allege that the septic tank, filled with sewage from defendant city, was maintained near her residence, and that foul, dangerous, and offensive odors came from said sewage onto plaintiff's premises and into her dwelling house, and deprived her of the comfort and enjoyment of her home, rendered same unsalable, and caused her to lose the reasonable rental value thereof. It may be true that the stench from the septic tank affected alike all who came in contact with it, but the fact that plaintiff owned and lived in property located near the tank, and was disturbed in the comfort and enjoyment of her home, by reason of the foul and offensive odors coming from the sewage in said tank, entitled her to maintain an action for said injuries. This tank was peculiarly injurious to plaintiff on account of its close proximity to her home. This being true, a petition alleging such facts states a cause of action, although it may not specifically allege that the injuries sustained by plaintiff were different in kind from those suffered by the public generally. * * *—Public Health Reports, Aug. 10, 1928.

Private Law Creating Special Sanitary and Maintenance District in Certain County Held Void and General Act Authorizing Creation of Sanitary Districts Held Constitutional.—(North Carolina Supreme Court; Drysdale, et al. v. Prudden, et al., 143 S. E. 530; decided June 6, 1928.) In this case, a controversy without action under section 626 of the Consolidated Statutes, the plaintiffs constituted the board of Druid Hills sanitary district and the defendants were engaged in the business of investment banking. The said sanitary district was created pursuant to an act ratified March 4, 1927, constituting chapter 100 of the Public Laws of 1927. At an election upon the question of the issuance of bonds by the district the vote was unanimous for the issuance of same. The plaintiffs took proceedings for the issuance of the bonds of the sanitary district in the aggregate principal amount of $75,000 for the purpose of acquiring, constructing, maintaining, and operating a sewerage system and water-supply system, and entered into a contract with the defendants whereby the latter agreed to purchase said bonds. The contract stipulated, however, that the defendants should not be obligated to take up and pay for the bonds unless they constituted the full and valid obligation of the sanitary district and were payable from an unlimited ad valorem tax upon all taxable property of the district and not from special assessments. The defendants refused to accept delivery of the bonds, but the agreed statements of facts in the case contained the provision that "if the plaintiffs are authorized to issue them and they will constitute the full and valid obligations of Druid Hills sanitary district, payable from an unlimited ad valorem tax upon all taxable property of said district, and not from special assessments, then the defendants stand ready, willing, and able to take up and pay for the same in accordance with their contract."

The identical territory comprising the said sanitary district was created or attempted to be created into a sanitary and maintenance district by a special act ratified March 7, 1927, constituting chapter 229 of the Private Laws of 1927. The State constitution, article 2, section 29, provided:

The general assembly shall not pass any local, private, or special act or resolution * * * relating to health, sanitation, and the abatement of nuisances; * * * Any local, private, or special act or resolution passed in violation of the provisions of this section shall be void. * * *

The supreme court stated that

practically only two material questions were presented, namely:

Was chapter 229 of the Private Laws of 1927 a local, private, or special act, in violation of section 29 of article 2 of the State constitution, and therefore void?

Was chapter 100 of the Public Laws of 1927 constitutional and the bonds valid?

The court held that chapter 229 of the Private Laws was void and that chapter 100 of the Public Laws was constitutional, and closed its opinion with the following language:

> The act (chapter 100) is sane, sound, and sensible—well within the police power of the State to pass. Therefore, we think that chapter 100 of the Public Laws of 1927 is constitutional, and that the proposed bonds under said act are valid and binding obligations of the Druid Hills sanitary district, and are payable from an ad valorem tax against all the taxable property within the boundaries of said district, and that the judgment of the court below should be affirmed.—Public Health Reports, Aug. 24, 1928.

City Held Liable in Damages for Sewage Pollution of Stream.—(Indiana Appellate Court; City of Frankfort v. Slipher, 162 N. E. 241; decided June 19, 1928.) The appellee owned a farm through which a natural watercourse flowed. In an action by him for damages against the city of Frankfort, it was alleged that the city had polluted the watercourse by unlawful deposit of sewage therein. The trial court found the following facts specially: That the city emptied its sewage into the watercourse; that such sewage was dangerous to public health, and had made the occupying of the dwelling houses on the appellee's land uncomfortable and unsatisfactory, and interfered with the use of his land; that the city could, at a reasonable cost, have erected a sewage-reduction plant, so that all of the sewage could have been rendered pure and harmless; that the city negligently failed to take any steps to erect a sewage-reduction plant or to reduce the unwholesome and dangerous condition of the sewage; and that the city negligently deposited the sewage in the watercourse to the injury of the appellee. The court concluded as a matter of law that the appellee should recover damages and entered judgment in accordance therewith. The appellate court affirmed such judgment saying:

> Under the facts as found by the court, public necessity did not call for or require the pollution of the water of either Prairie Creek or South Fork, and, since appellant, by the expenditure of a reasonable sum of money, could have adopted a method of purifying the sewage, the judgment should be affirmed.—Public Health Reports, Aug. 31, 1928.

Joint Conventions by Municipal Organizations at Cincinnati

The National Municipal League, the Governmental Research Association and the National Association of Civic Secretaries will hold their 1928 Conventions jointly in Cincinnati, Oct. 15, 16, and 17 with headquarters at the Hotel Sinton. The Governmental Research Association and the National Association of Civic Secretaries meet alone on Oct. 15; on Oct. 16 and 17 the three organizations meet together.

Murray Seasongood, Mayor of Cincinnati will officially welcome the members of the Governmental Research Association, at a noon meeting Oct. 15. The leading feature of the morning's program will be an address by John B. Blandford, Jr., Director, Cincinnati Bureau of Municipal Research on "A Fact Basis for Community Action." During the afternoon simultaneous round table sessions will be held, as follows: Special Assessments, Philip H. Cornick presiding; Financial Statistics of Cities, C. E. Rightor, presiding. A feature of the round table on Financial Statistics of Cities will be an address by Starke M. Grogan, Chief Statistician United States Bureau of the Census, on "Compiling Financial Statistics of Cities."

"Methods of Securing Support for a Civic Project," with a discussion led by Nat Spencer, Secretary, Citizen's League, Kansas City, Mo., will be a feature of the dinner meeting of the National Association of Civic Secretaries, Oct. 15.

"The City's Responsibility in Housing" will be the topic discussed at a general session on the afternoon of October 16. This meeting will be addressed by S. J. Herman, Executive Director, Michigan Housing Association, who will speak on "State or Regional Credits as a Practical Substitute for Municipal Recognition of Housing as a Public Utility." Addresses will also be given by John Ihlder, Housing Expert, Washington, D. C., and Bleecker Marquette, Executive Secretary, Public Health Federation, Cincinnati. At a dinner meeting that evening among the speakers will be Dr. Charles A. Beard, who will discuss "The City's Place in Civilization." Simultaneous round table sessions will be held during the morning of the 16th as follows: The Negro and Public Affairs, Alfred Bettmen, presiding. Addresses will be delivered by Robert T. Lansdale, Executive Secretary, The Council of Social Agencies of Montclair, N. J., and Ralph Johnson Bunche, Howard University, Washington, D. C. Measurement Standards in Government. Colonel H. M. Waite, presiding. A report will be given by Clarence Ridley, secretary, National Committee on Municipal Standards.

A comparison of certain municipal administrative practices in America and Great Britain by Arthur Collins, financial adviser to local authorities of England will be the leading feature of the luncheon meeting on Oct. 17. During the morning, round tables will be held as follows: Proportional Representation and Democracy in Elections, C. A. Dykstra presiding. An address will be given by Joseph P. Harris, University of Wisconsin, Selling the Work of Government to the Public, Stephen B. Story, City Manager, Rochester, N. Y., presiding. Addresses will be given by Wylie Kilpatrick, University of Virginia, Herman C. Beyle, Syracuse University, and Moses Strauss, editor, Cincinnati Times-Star.

General arrangements for the conventions are in charge of Russell Forbes, Secretary, National Municipal League, and local arrangements are being taken care of by John B. Blandford, Jr., Director, Cincinnati Bureau of Municipal Research.

Community Bath Houses with Fees Suggested

Gov. Fuller of Massachusetts spoke at the public hearing held by the Salisbury Beach and Duxbury Beach Reservations Commission in Cottage Owners' Association Hall at Salisbury Beach, Mass., on the bathing beach problem. Extracts from his speech, as given below show an interesting trend of thought.

"This commission will consider, I assume, some fairly definite unit plan applicable to our various beaches such as, for example, a community-owner bath house at each of our large beaches," he said. "These bath houses should be provided with facilities that would take care of, let us say, 1,000 people. There would be a superintendent in each. I assume that these facilities could be made practically self-supporting. A nominal charge would be made for the use of a bathing suit and the facilities of the bath house. This bath house would be constructed by the county or by a group of cities within a reasonable radius of the beach.

"A group might be made up of Newburyport, Lawrence, Haverhill, Amesbury, Merrimac, and Salisbury. Those cities would form such a combination as that which we have in our Metropolitan District of Boston.

"To one who has traveled in the Middle West it is not difficult to realize that one of the priceless assets which we have in Massachusetts is our seashore washed by the waters of the Atlantic.

"It is an important problem you gentlemen are applying yourselves to and I wish you well and promise you my cooperation. If you want to start your first unit here in Salisbury Beach and you decide upon one plan where the State or county pays one-half the cost, leaving the rest perhaps for the local communities to raise, I would be very glad of the privilege of paying 50 per cent of the cost which would otherwise be assessed upon the various communities in order that this program might get under way at once."

Asphalt and Granite Block Pavement Methods in the City of Chicago

How Heavy Traffic and Light Traffic Pavements Are Laid on Assessment Jobs

OF the several types of paving used by the City of Chicago on the many streets of the various sections of the city, two well known types still used to a large extent are granite block and asphalt, both constructed on a 6 or 8-in. concrete base. The granite block is used on some through streets that carry a heavy street car and truck and wagon traffic, where traffic conditions are of the most severe type. Asphalt is used on boulevards and outlying residential streets. Both types are represented in this article.

Western Avenue.—This is a through north and south street terminating in a main state highway south of the city and affords access to the main highways to the north at Evanston, Ill. Western Ave., north of Belmont Ave., was paved with asphalt in 1927, the part south of Belmont Ave. and north of Fullerton Ave. has just been completed. This street was recently widened by condemnation from 66 ft. to 100 ft. Inside the city, the traffic is mixed and of the heaviest type. The old pavement has been torn up and the street is being widened to 27 ft. on each side of the double track line of the surface lines in the center of the street, making a total roadway width of 70 ft. The pavement is a granite block surface on a 1½ in. sand-cement cushion 1:4 mix, resting on an 8 in. concrete base. The base mix is a 1:3:6 concrete. No reinforcing is

Granite Block Paving on Western Avenue, Chicago

1—Laying Block; 2—Closeup of Laying Block Under Watchful Eye of Inspector; 3—This Mixer Furnished the Grout; 4—View of Completed Work; 5—View of a Difficult 3-Way Intersection. Traffic Lights Synchronized for 3-Way Interval Control the Traffic with One Street Moving and Two Standing.

used, and no provision is made for expansion in the base. The section of the base is curved upward toward the center to afford the desired crown. Concrete curbs 9 in. by 21 in. deep are built prior to laying the base. The base is laid with the usual organization, as later described. The sand in the sand-cement cushion is of ordinary torpedo sand of the same grading as is used in the grout to fill the spaces between the block.

Laying the Block.—About 80 per cent of the old 5 in. granite blocks were relaid, adjacent to the curb. The new granite block are delivered by motor truck to the subgrade and piled so as to minimize rehandling to the layer. Two layers then work side by side at convenient intervals, laying the block in place on the sand-cement cushion ready for the grouting. The work of each pair is divided by a line staked down the center of the 27 ft. strip in order that each man will have a uniform width to lay and in order that each man's work can be easily observed by the foreman. From 10 to 24 layers are on the job on any one day, with an average of about 18, and one helper is employed for each layer. A good man averages about 40 sq. yd. per 8 hour day. Felt expansion joints are placed across the granite pavement at intervals of 30 ft.

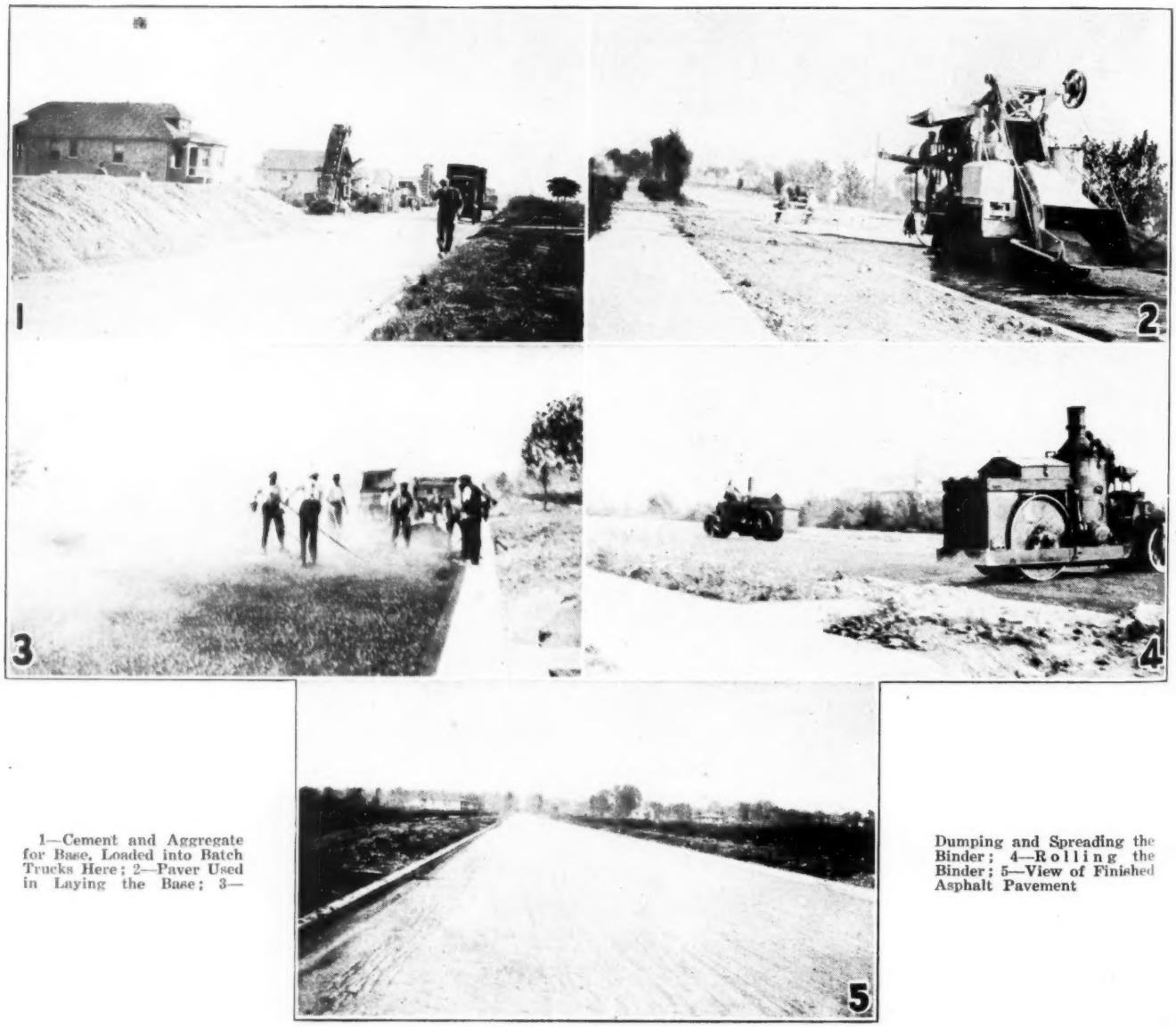
Grouting.—The 1:1 cement and sand grout is mixed in a 1 bagger Kwik-Mix tilting mixer on a nearby intersection, with the sand and cement piled alongside on the pavement, and with water obtained from the nearest fire hydrant. Two men operate this mixer.

Two wheelers with concrete buggies transport the grout to the point of pouring and the grout is poured and broomed over the pavement until joints are almost filled. Blocks and sand are handled in wheelbarrows.

This pavement was being laid for the Board of Local Improvements by the Ready Coal and Construction Co., Chicago, represented on the work by Lawrence Ready, supt., while the city wa represented by J. J. Norton, inspector

A Large Asphalt Job.—Between Oak Park Avenue, Harlem Avenue, Armitage Avenue and North Avenue, the city is paving the complete street system with asphalt, totaling about 87,00 sq. yd. separated into two contracts These residential streets are to consis of a 6 in. concrete base, 2 in. of binder and 1½ in. of top, laid into pavement of normal residential width. Curbs an gutters are of the combination type, o concrete construction. Elevating graders and dump wagons were used on the subgrade work.

Materials for Base.—Stone and sand for the base concrete were delivered to a nearby pavement by motor truck from the material yard and dumped along the curb. Sacked cement was delivered by trailer and the trailer spotted between the sand and stone so that the cement could be unloaded direct into the batch trucks. Barber Greene loaders, one for sand and one for stone,



1—Cement and Aggregate for Base, Loaded into Batch Trucks Here; 2—Paver Used in Laying the Base; 3—Dumping and Spreading the Binder; 4—Rolling the Binder; 5—View of Finished Asphalt Pavement

Asphalt Paving in New Residential Area

were used to take the aggregates from these stock piles and load into the batch trucks. Five men were used on the cement, and a loader operator with one laborer were used on the sand and one operator and two laborers were used on the stone. A fleet of 8 Hug trucks with single batch Anthony dump bodies were used to deliver the dry batches from the stock piles to the paver.

The Paver.—A Rex 27-E paver was used to mix the concrete for the base. This paver was manned by one operator, one helper, one man on the subgrade, one dumper, three grade men, four puddlers, two broom men, and one tamper. With this organization, and a minute mix, the contractor was able to lay 1,900 sq. yd. of base per 8 hour shift.

The Asphalt Gang.—As soon as the base had cured sufficiently, the binder course was then laid. Using 18 trucks and a haul of about 9 miles from the asphalt plant, and with 25 men on the grade, and three rollers, the contractor could average 3,000 sq. yd. of finished pavement per 9½ hour day, with the rollers working 12 hours. Binder was laid in the afternoon and top in the following morning. One man was employed sprinkling cement on the rolled top with a broom and another man was used to paint the gutters. The roller equipment used was a 15-ton Iroquois roller, a 10-ton Erie, and an 8-ton Iroquois. With this equipment, the both courses were rolled until accepted by the inspector.

On this work, done by the White Construction Company, the contractor was represented on the base work by C. H. Watson, foreman, and on the asphalt work by Wm. T. McCarthy, foreman. The Board of Local Improvements was represented on the base work by Don Barry, inspector, and on the asphalt by T. F. Turner, inspector.

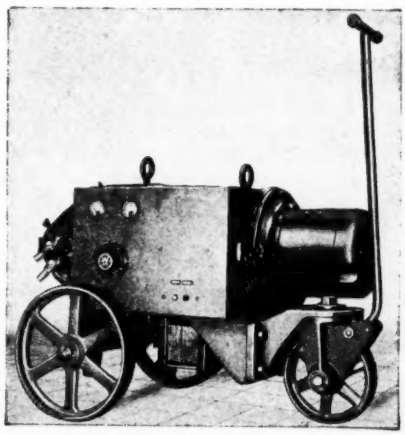
The planning and supervision of the work in general was done for the City of Chicago, by the Board of Local Improvements, of which M. J. Faherty is president, while the work was done under the general direction of Hugh J. Fixmer, division engineer.

Westinghouse Announces New Arc-Welder

A new Westinghouse, 200 ampere, single-operator welding set has been designed to meet every requirement in both the shop and field, and to serve all applications within its rating, with speed and economy, according to the manufacturers. This new unit is outstanding in its features of simplicity of operation and compactness in construction.

The set is started by connecting directly across the line by means of a Linestarter and Linestart motor. Starting and stopping are accomplished by the simple operation of a push botton. A single rheostat varies the arc current over the entire welding range. Accurate adjustment over the welding range, from 60 amperes to 300 amperes, is afforded by steps of 5 amperes.

The motor-generator, and control equipment are assembled in a totally enclosed frame. The exciter, which is overhung from the motor end, is securely fastened to the unit frame. This type of construction guards the operator against injury, and protects the set from dirt and falling objects. In performance tests welding operations have been carried on while the sets were suspended at every angle that could possibly be required in any application. Operation is as satisfactory when the set is placed on end, as



New 200-Ampere Arc-Welder

when it is in the normal position, it is claimed.

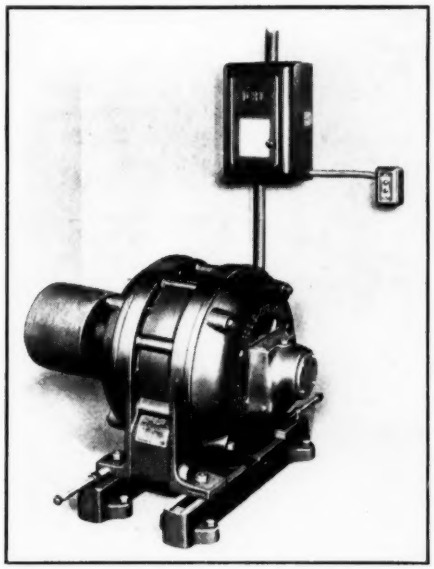
Steady welding current, insuring thorough penetration and fusion of the weld, is obtained from a constant current generator. A separate exciter is used in all Westinghouse single-operator welders. It insures a high speed of welding, and a machine whose generator voltage responds to any changes in arc conditions this tending to maintain a constant rate of fusion of the electrode.

The unit is rated at 200 amperes, 1 hour, 50 deg. rise on a resistance load at 25 volts which conforms to the standard rating of the National Electrical Manufacturers Association. The motor is wound for 220 or 440 volts and is assembled with the necessary connections made for operation from a 3-phase 60-cycle circuit. If it is desired to operate the unit from a 440 volt, 3-phase, 60-cycle circuit, it is only necessary to replace the operating coil on the magnetic starter, and to reconnect the motor leads.

Toledo May Have City Manager.—The city of Toledo, O., will vote in November on the adoption of a new charter, the distinctive features of which provide for a city manager and for a council elected by proportional representation.

Line Start Induction Motors

A line of squirrel cage induction motors suitable for starting on full line voltage is being placed on the market by Allis-Chalmers Manufacturing Company. These motors are normal torque, high reactance machines and will not draw starting current in excess of the limits recommended by the Electrical Apparatus Committee of the National Electric Light Association. They are built in ratings 7½ to 30 h.p., 600 to 3,600 r.p.m., low voltage, and are available with either sleeve or roller bearings. All features of Allis-



New Line Start Induction Motor of Type Recently Introduced by Allis-Chalmers

Chalmers construction as employed in squirrel cage motors are maintained in this new line. A magnetic switch with push button control is the only starting equipment required.

New Device for Protecting Pedestrians.—A new device for the protection of pedestrians has been placed in service by the city of Los Angeles, Cal. It is intended as a signal for approaching street cars as well as to safeguard pedestrians boarding the trolley. As the street car nears, the pedestrian pushes a button on the post and the signal flashes a red light, halting vehicles and flooding the approach to the track and the loading zone with a brilliant light.

Sixty-eight Administrative Areas in One County.—According to the recently published report of Harland Bartholomew and Associates on county planning for Lucas County, O., that county has 13 townships, 8 sanitary districts, 17 school districts, 9 incorporated cities and villages, and 21 unincorporated towns and minor civil divisions—a total of 68 administrative areas in the county.

International Association of Sanitation Officials

9th Annual Conference to Be Held Oct. 8 and 9 at Toronto, Ont.

THE leading city officials of the United States and Canada engaged in street sanitation work will meet at Toronto, Ont., on Oct. 8 and 9. This meeting, the 9th annual conference of the International Association of Street Sanitation Officials, promises to be the best ever held by the association. The headquarters of the conference will be King Edwards Hotel, Toronto. The program and entertainment which the association officials have planned in co-operation with representatives of the host city, Toronto, are believed to outclass any yet offered. Every minute promises instructive talks and discussions or unusual recreation which no city official will regret having had a part in. The whole gamut of problems which daily or weekly confront street officials will come in for attention and many a worthwhile idea will be passed along by men with long experience.

One of the features of the conference will be a talk on "Disposal of Garbage by the Fermentation Process." This will be given by A. Boniface, Village Engineer of Scarsdale, N. Y., which has adopted an Italian plan to American conditions. Out in St. Louis, Mo., they have given much thought to parking and the results of efforts to solve the problem will be told by Robert B. Brooks, Superintendent of Streets and Sewers, in a paper, "Municipal Parking Grounds as a Means of Helping the Street Cleaning Problem."

Knowing what departmental employees are really doing, the streets they are covering and the kind of service they are giving is information that many city officials in charge of garbage and refuse removal like to have. Mr. Samuel A. Greeley, Consulting Engineer of Chicago, Ill., has had quite a bit of experience in keeping records of this kind. He is to tell of his experience and give ideas to others during the course of a talk on "Routine Records of Collection Service."

Littering of city streets with the advertising matter of merchants and others causes many a worry for officials charged with keeping thoroughfares looking well. Antagonism of merchant-taxpayers is not always wise, yet appearance must be kept up. C. O. Davis, Superintendent of Street Sanitation in Milwaukee, Wis., has some ideas on this problem and will tell about them in a talk on "Advertising Matter Distributed or Posted on City Streets."

The chap who calls from his store or office as well as the housewife who hits the ceiling because garbage was not taken or a bunch of refuse was left in front of the premises will not be overlooked at the Conference either. The standing which an administration has in a community often depends much on the kind of service the city departments give. In Syracuse, N. Y., they take great pains to do things right and they have worked out a system for handling complaints which has had remarkable results. Morris S. Jones, Deputy Commissioner of Public Works of Syracuse, is going to tell how they do it in a talk on "Handling Complaints."

Maintenance of pavements after they are once laid and accepted is another big problem for city officials. The steady increase in traffic has given pavements much harder usage than in days past and much deep thought has been given to ways and means of getting funds to keep the roadways in satisfactory shape. There are some indications that a system similar to the gasoline tax plan must be adopted so that he who rides must pay. C. A. Hillegas, Superintendent, Department of Highways and Sewers, Pittsburgh, Pa., is one of many who face the question: What to do? He will give his views in a talk on "A Vehicle Tax for the Maintenance of Pavements."

Who Should Be Who?—Sometimes things do not run as smoothly as they might around City Hall because there is a division or over-lapping of authority. Team-work helps and they have found it to be so in Detroit, Mich. Captain Harrington Place, Engineer, Detroit Bureau of Governmental Research, will discuss the difficulties which can be adjusted and overcome in a talk on "Duties and Powers That Should Be Delegated to the Street Sanitation Official."

The talks mentioned above are but a few of those which are scheduled to be given at Toronto, as will be noted from the program which is printed in full below:

Program 9th Conference of International Association of Street Sanitation Officials
Monday, Oct. 8th

9:00 A. M.—Board of Governors Meeting.
9.00 A. M.—Registration, Mezzanine Floor, King Edward Hotel.
10:30 A. M.—Opening Session of 9th Conference, Pompeian Room, Mezzanine Floor, King Edward Hotel.
Address of Welcome.
Response.
President's Message.
Report of Board of Governors, Treasurer and Secretary.
Discussion of Subjects.
12:30 P. M.—Lunch, Pompeian Room, King Edward Hotel.
1:30 P. M.—Continue business session, Pompeian Room, King Edward Hotel.
7:00 P. M.—Dinner and entertainment. Pompeian Room, King Edward Hotel.

Tuesday, Oct. 9th

9:30 A. M.—Continue business session. Pompeian Room, King Edward Hotel.
1:15 P. M.—Leave Victoria Street entrance of King Edward Hotel for Lunch at Palais Royale, from there continue on inspection trip as guests of the City of Toronto.

1—Disposal of Garbage by the Fermentation Process—Mr. A. Boniface, Village Engineer, Scarsdale, New York.

2—Preventive Street Cleaning—Every Citizen a Member of the Street Cleaning Department—To be presented by a Member of The American City staff.

3—Importance of Street Cleaning—From the Viewpoint of a Physician, Who is Also a City Official—Dr. M. B. Herlong, City Commissioner, Jacksonville, Florida.

4—The Budget as It Might be Applied to Street Sanitation Activities—Mr. Elmer C. Goodwin, Examining Engineer, Department of Street Cleaning, New York City.

5—Snow Removal—Three-minute talks by officials from the snow belt.

6—Municipal Parking Grounds as a Means of Helping the Street Cleaning Problem—Mr. Robert B. Brooks, Director, Dept. of Streets and Sewers, St. Louis, Missouri.

7—Is It Desirable to Have Street Cleaning Activities Organized as a Bureau or Division of Some Department—If So, Into Which Department Does Such Supervision Naturally Fall?—Three-minute talks.

8—Routine Records of Collection Service—Mr. Samuel A. Greeley, Consulting Engineer, Chicago, Illinois.

9—Group Insurance for Municipal Employees—Mr. P. J. Hurtgen, Director of Public Works, Kenosha, Wisconsin.

10—Advertising Matter Distributed or Posted on Streets—Mr. C. O. Davis, Superintendent of Street Sanitation, Milwaukee, Wisconsin.

11—Handling Complaints — Mr. Morris S. Jones, Deputy Commissioner of Public Works, Syracuse, New York.

12—Vehicle Tax for the Maintenance of Pavements—Mr. C. A. Hillegas, Superintendent, Dept. of Highways and Sewers, Pittsburgh, Penna.

13—Duties and Powers That Should Be Delegated to the Street Sanitation Official—Captain Harrington Place, Engineer, Detroit Bureau of Governmental Research, Detroit, Mich.

14—Maintenance of Sewage Collection Systems—Mr. W. T. Knowlton, Sanitary Engineer, Los Angeles, California.

15—Street Maintenance—Mr. R. C. Harris, Commissioner of Works, Toronto, Canada.

16—Municipal Airports (Motion Pictures Showing Progress During Construction.)—Mr. Edwin A. Miller, Supervisor of Maintenance, Department of Public Works, Rochester, New York.

17—Rules and Regulations Governing the Use and Operation of Airports—Mr. Lester W. Herzog, Commissioner of Public Works, Albany, New York.

18—Alley Cleaning and Requirements of Property Owners in This Respect—Three-minute talks.

19—Public Convenience Stations, Their Construction and Control—Mr. W. C. Earle, City Engineer and Superintendent of Streets, Pasadena, California.

20—Benefits to Be Derived From the Use of Mechanical Devices in Street Sanitation Operation—Three-minute talks.

21—Methods Pursued to Prevent Promiscuous Dumping of Rubbish—Mr. W. J. Galligan, Assistant Superintendent, Bureau of Streets, Chicago, Illinois.

22—What Is Being Done to Streets on Which Are Located Abandoned Street Car Tracks?—Mr. L. P. Booz, City Engineer, Perth Amboy, New Jersey.

Opening Morning Session—October 9th—Special Order

Discussion of Report of Committee to Study Methods and Costs of Different Garbage Disposal Systems—led by Mr. Elmer C. Goodwin, Examining Engineer, Department of Street Cleaning, New York City—Three-minute talks.

The officials of the International Association of State Sanitation Officials are as follows:

President, Theodore Eichhorn, Superintendent, Department of Streets and Public Improvements, Erie, Pa.; First Vice-President, Robert B. Brooks, Director, Streets and Sewers, St. Louis, Mo.; Second Vice-President, Elmer C. Goodwin, Examining Engineer, Department of Street Cleaning, New York City; Third Vice-President, A. B. Cook, Chief Sanitary Inspector, Charlotte, N. C.; Secretary, A. M. Anderson, 10 South LaSalle Street, Chicago, Ill.; Treasurer, P. J. Hurtgen, Director of Public Works, Kenosha, Wis.

New Purification Plant of Greenwich Water Co., Greenwich, Conn.

New Installation Has Many Special Features

By E. SHERMAN CHASE
Of Metcalf & Eddy, Consulting Engineers, Boston, Mass.

IN line with a policy of providing an adequate supply of water of high quality, the Greenwich Water Co., under the guidance of its president, Eben F. Putnam, has recently constructed and placed in operation a modern water purification plant. This plant consists of a low lift pumping station, aerators, chemical mixing tanks, coagulation basins, rapid sand filters, clear water basin and chlorination equipment.

As constructed the coagulation basin has a rated capacity of 6 m.g.d., the filters 4 m.g.d. and the clear water basin storage of 1 m.g. The coagulation basin has excess capacity in order to permit its use in conjunction with existing pressure filters. The plant is so laid out as to be capable of ultimate expansion to 8 m.g.d. capacity.

Intake and Low Lift Pumping Station.—The existing Putnam Lake intake serves the new plant through a branch of the 30-in. pipe which originally served the pressure filters directly. In order to increase available storage and to provide adequate head after filtration, the filter plant was placed above high water level on the side hill just downstream from the reservoir, and a low lift pumping station was provided.

This pumping station is a one-story brick structure with a main pump room 22 ft. x 42 ft. inside with two wings approximately 11 ft. by 14 ft. inside. In one wing is emergency chlorine equipment for treating raw water should it ever be necessary to bypass the filter plant. In the other wing are toilet facilities and in the basement are heating equipment and coal bunker.

The pumping equipment comprises two motor-driven, horizontal centrifugal pumps. The pumps were manufactured by the Warren Steam Pump Co. with rated capacities of 8 m.g.d. each. Reservoir water comes to the pumps under a gravity head of about 20 ft. with full reservoir, the head varying according to water level in the reservoir. The raw water is pumped to the filter plant, either to aerating nozzles or to the chemical mixing tanks. Regulation of pumping is secured by means of a butterfly valve in the discharge line automatically controlled by the water level on the filters. As the water level over the filters rises, the valve closes, thereby increasing the friction head against the pumps and reducing the discharge, the reverse being the case with falling water level on the filters. Variable speed control is also provided for the pumps to permit of economical operation. A Venturi meter is installed on the 24-in. raw water discharge from the pumps and a recording indicator register is located in the office of the chemical house.

Aeration.—Aeration is provided by 48 Sacremento type nozzles located on the roof of the coagulation tanks. These nozzles are symmetrically placed in a grid of cast iron pipe raised on concrete piers above the roof. There are six rows of 8 nozzles each. The sprayed water falls upon the roof and thence drains to a conduit leading to the chemical mixing tanks. The nozzles have 2 lb. cones and throw a spray of approximately 17 ft. in diameter with a nozzle head of about 5 ft. Three sides of the aeration roof are surrounded by a fence of corrugated zinc 7 ft. 6 in. high. On the fourth side are the control valve and walkway.

Chemical Mixing Tanks.—There are two tanks in which the aerated water receives the dose of chemicals. These tanks are 18 ft. square in plan and carry a water depth of 17.5 ft. Adequate mixing is secured by mechanical stirrers consisting of wooden paddles operated by electric motors and so geared to these motors as to revolve at a rate of about one revolution per minute. Interchangeable sets of gears are also provided for other speeds. With the plant operating at its ultimate capacity of 8 m.g.d. these tanks give a total mixing period of approximately 15 minutes. Each tank is provided with 24-in. inlet and outlet and with a 12-in. drain.

For application of chemicals there are three motor-operated No. 3 Gauntt dry feed machines and space is provided for a fourth. The chemicals used are ordinary filter alum (sodium aluminate) and soda ash. The dry chemical is fed to the machines through hoppers from the chemical storage room on the floor above. In the two alum machines a stream of water mixes with and dissolves the chemical and the solution thus made is fed by gravity through rubber hose to the water entering the mixing basins. The soda ash is applied in a similar way to the filtered water as it leaves the filtered water reservoir, to neutralize the increase in acidity brought about by the use of alum. The chemical feed machines have been calibrated and control of chemical application is very accurate. If it proves necessary in the future the fourth chemical feed machine can be installed for adding soda ash to the raw water, although generally the raw water contains adequate alkalinity to react with the alum.

Settling Basins.—There are three settling basins, or rather one basin divided into three separate compartments by partition walls. Each compartment is 95 ft. long by 33 ft. wide inside, with a central, longitudinal baffle wall of plank around which the treated water flows before passing over outlet weirs to a channel leading to the filters.

The basin is covered by a flat slab roof supported on 15 columns. The maximum water depth varies from 14 ft. to 16 ft. 6 in. as the floor pitches to 12-in. drains. The distance between water level and underside of roof averages about 2 ft. Access to the basin is provided by 12 manholes, four over each compartment.

One end of the basin consists of a hollow wall 3 ft. wide inside, with horizontal partitions forming conduits about 4 ft. deep. These conduits starting with the uppermost, serve the following functions: first, convey aerated water to the chemical mixing tanks; second, convey chemically treated water and settled water from the settling basins to the filters; third, convey chemically treated water from the mixing tanks to the settling basins; fourth, drain the settling basins. Near one end of these channels is a bypass chamber with adjustable weir over which a portion of the chemically treated and settled water is discharged to a pipe leading to the old pressure filters.

The settling basin gives a theoretical detention of 4 hours with a flow of 6 m.g.d. For the ultimate capacity of 8 m.g.d. a fourth compartment will be added. Conduits, piping, etc., are arranged so that their addition can be made with little difficulty.

Filters.—The ultimate capacity of filters is 8 m.g.d., but at present only 4 m.g.d. capacity has been provided. There are now eight units of filters located in a wing extending from one side of the chemical house. The future units will be located in a second wing extending symmetrically from the opposite side. Each unit has a capacity of 0.5 m.g.d. at a rate of filtration equivalent to 125 m.g.d. per acre.

The filter boxes are of reinforced con-

crete, 12 ft. 8 in. by 16 ft. 6 in. in plan, inside dimensions, and 10 ft. deep from floor to top. Across one end of each filter box is a concrete baffle wall extending from the floor to within 2 ft. 7 in. of the top of the box. This wall forms an inlet chamber through which settled water is applied to the filters and from which wash water is discharged. The net filtering area of each filter is 12 ft. 8 in. by 13 ft. 10 in. or 175 sq. ft.

The filter medium consists of 30 in. of sand over 18 in. of graded gravel. The specifications for sand called for an effective size of not less than 0.30 mm. nor more than 0.40 mm. and a uniformity coefficient not greater than 1.60. In the case of six filters Cape May sand was used having an effective size of 0.36 to 0.37 mm. and a uniformity coefficient of 1.48 to 1.55. For the remaining two filters Cow Bay sand was used having an effective size of 0.37 mm. and a uniformity coefficient of 4.65. The use in two of the filters of Cow Bay sand whose uniformity coefficient departed so materially from that which has been considered good practice, was due to the desire to determine on a working scale whether this sand would accomplish satisfactory results. Furthermore, the cost of the Cow Bay sand delivered, was less than that of the Cape May sand.

The underdrains consist of 3-in. cast iron pipe laid 6 in. center to center over the filter floor. These pipes are provided with ¼-in. holes on the two lower quadrants, these holes being staggered on 6 in. centers. The underdrains of each filter connect through vertical tees to a central concrete conduit from which filtered water passes through a Builders Iron Foundry rate controller to the main effluent pipe leading to the clear water basin.

Each filter unit contains two wash water troughs of steel, 16 in. wide and painted. The tops of the troughs are 2 ft. 6 in. above the surface of the sand.

Wash water from the clear water basin is provided by two motor-operated, automatically primed, centrifugal pumps discharging directly to the filter underdrains through a 16-in. pipe. These pumps have a capacity each of 4 m.g.d. One pump at a time is operated for filter washing and is started and stopped by push button control in the operating gallery. The normal vertical rise of wash water over the filters is 24 in. per minute.

Clear Water Basin.—The clear water basin is a covered reinforced concrete structure 74 ft. wide by 150 ft. long inside dimensions with a maximum water depth of 12 ft. 6 in. equivalent to a capacity of 1 m.g. The whole basin is covered by a slab roof supported by three rows of columns. The top side of this roof pitches to its perimeter around which is a low concrete wall so that a secondary aerator for filtered water can be installed if future experience shows the necessity for such installation.

The corner of the basin nearest the filter house is partitioned off forming a compartment about 17½ ft. x 36½ ft. This compartment is also divided in halves along its length by a wooden partition. The object of this compartment is to provide ample contact period for the chlorinated filter effluent before mixture with stored water. An electric light is provided at the bottom of this compartment so that observations can be made of the turbidity of the filtered water.

Inlet and outlet pipes are 24 in. in diameter. In addition a 6-in. drain leads from one end of the basin to the main drain from the filters. In one corner of the reservoir is an 8-in. vertical riser which contains the water level gage.

Chemical House.—The chemical or head house consists of a two story and basement main building and two wings of one story and basement. A third wing will be added when more filters are built.

The first floor of the main building contains the entrance vestibule, corridor, office, laboratory and toilet facilities. An ornamental fountain is in this corridor facing the entrance. One wing of the building covers the filters and operating gallery under which is the pipe gallery. The other wing covers the chemical mixing tanks and appurtenances.

The basement of the main building contains the wash water pumps and motors, a service pump, heating boiler, coal bunker, locker room, toilet, domestic water supply and elevator machinery. From one side of the main basement the filter pipe gallery leads and from another side a gallery extends around the chemical tanks.

The second floor contains the chemical storage room and chlorine room. The chlorine room houses two vacuum type Wallace & Tiernan chlorinators for applying chlorine to the filtered water prior to entrance to clear water basin. An electrically operated service elevator runs from the basement to the second floor.

Pipe Gallery.—The pipe gallery is 14 ft. wide by 16 ft. high. The uppermost pipe is the 20-in. settled water pipe from which 8-in. branches lead to each of the filter units. Next below is the 16-in. wash water pipe with 16-in. branches to the filters. Beyond the wash water pumps and on this 16-in. line is a wash water rate controller tube with indicating, recording and registering apparatus in the office. Below the wash water pipe is the filtered water pipe, 20 in. in diameter from which 6-in. branches lead to 20-in. headers from the filter underdrains. Builders Iron Foundry rate controllers are located on each of these 6-in. branches. The lowermost pipe is an 18-in. tile drain, surrounded by concrete, on which are concrete junction boxes which in turn connect with the inlet compartments of the filter boxes through 16-in. pipes. Four-inch bypass pipes permit filtering to waste into the drain. All pipes are provided with the necessary hydraulically operated valves controlled from operating tables on the floor above. A plank walk extends along the gallery just above the filtered water pipe. Sampling cocks are provided on each filter outlet. The chlorination apparatus is connected to the 20-in. filtered water pipe ahead of the clear water basin shortly before the pipe leaves the basement of the chemical house.

Special Features.—In designing the plant, an attempt has been made to reduce the amount of supervision required in the operation of the various parts. Several automatic and remote control features have been installed for this purpose which deserve a short description.

The low lift pumps are equipped with slip ring motors which permit of adjustable speed control. Extension relay circuits for the control apparatus have been placed in the office of the chemical house and the speed of the pumps may be controlled from either the chemical house or low lift pumping station.

A special apparatus consisting of a float, differential mechanism, 4-way valve and pivot valve, controlled by the water level on the filters regulates the flow through the plant by throttling the discharge of the low lift pumps.

The necessary valves controlling the inlet, outlet, wash water and drain ports of the filter units have been made to operate hydraulically from hand levers on the operating tables. This permits all necessary valves to be operated on the table top in front of each unit.

Instead of the usual wash water tank for washing the filters, there has been installed duplicate wash water pumps. These pumps may be started and stopped from a push button station in the filter wing. There are also telltale lights in the operating gallery to indicate which pump is running.

An automatic priming device has also been included which keeps the pumps primed at all times and on failure of the priming system throws out the electrical circuit so that the pumps cannot be started until the priming is complete.

In addition, a rate controller has been placed on the discharge of the pumps which automatically holds the rate of washing on the filters constant.

An annunciator has been placed in the office with connections indicating high and low water in the filtered water reservoir. Low pressure is also indicated in the domestic water supply system which furnishes motive power for the hydraulic valve. The annunciator operates an industrial howler.

Interconnecting telephones have been installed between chemical house, low lift pumping station and the old pressure filter plant. In addition there is a public telephone connection to take

care of emergency calls from various parts of the distribution system.

Miscellaneous.—For service water for flushing, lawn sprinkling and other general but intermittent uses a 250 g.p.m., motor-driven, centrifugal pump and piping system to points of expected use have been provided.

A surface drain removes condensation and leakage collecting in the basement of the chemical house.

Water supply for the laboratory, toilets and operation of hydraulic valves is obtained from small, pneumatic pressure tank systems installed in duplicate. These tanks are of 500 gal. capacity each, water from the clear water basin being pumped into them by 50 g.p.m. centrifugal pumps. A pressure switch has been installed on the domestic supply pumps to permit the pumps to start when the pressure in the pneumatic storage tanks falls below a certain limit and to stop the pumps when the proper pressure is restored to the system. A small air compressor is also provided for adding air to the tanks from time to time.

The sewage from the toilets of pumping station and filter plant is discharged into leaching cesspools. The wash water and other drainage is discharged into the stream below the reservoir.

Operation.—The filter plant was first put into regular operation the latter part of April, 1928. It is operated under the general supervision of W. Jay Willson, superintendent of the Greenwich Water Co. and under the direct supervision of Harold C. Chandler, Chemist-in-Charge, who was formerly chemist at the Cambridge, Mass., filter plant.

During the period of tuning up some trouble was experienced with the water level controller regulating the discharge from the low lift pumps. This trouble was remedied by changing the gearing connected to the cam operating the pilot valve controlling the hydraulically operated butterfly valve in the discharge pipe from the pumps.

Filter runs between washing were also unduly short during the first few weeks. Increasing the rate of washing of the filters to about 30 in. vertical rise per minute and scraping off the top 2 in. of fine material resulted in an improvement in filter runs. Copper sulphate treatment of Putnam Lake also may have been of some value in destroying microscopic organisms which if reaching the filters in any quantity would tend to decrease filter runs.

An interesting feature of the purification plant is the operation of the old pressure filters in parallel with the new gravity filters. The preliminary treatment of the raw water by coagulation and settling at the new plant prior to the application of this water to the pressure filters has brought about a marked improvement in the quality of the effluent from these filters. Inasmuch as it was desired to prevent any increase in corrosive properties of the filtered water, resort has been had to the application of soda ash to the filtered water. This application is made by one of the dry feed chemical machines at the new plant to the water drawn from the clear water basin. The water from the basin flows by the old filter plant in the 30-in. pipe originally carrying raw water to these filters. Below the old filters cross-overs exist which permit mixing of the effluents from both old and new plants. By overdosing with soda ash the effluent of the new plant and by chlorinating it with the chlorine equipment formerly used for chlorinating the pressure filter influent the effluent of the pressure filters is corrected for corrosive qualities by the excess soda ash and disinfected by chlorine carried in the effluent from the new plant. To apply soda ash directly to the pressure filter effluent would require an additional chemical feed machine and injector equipment. Direct chlorination of the pressure filter effluent would have required further changing of equipment. The results obtained by the present method of operation appear to have been satisfactory.

Operation Data.—In general, the quantity of water treated by both filter plants has averaged about 3 m.g.d. each or 6 m.g.d. total. In the case of the new plant the average length of filter runs gradually increased from 8½ hours in May to 11 hours in August. The pressure filters during this period have required washing but once daily. This has been due, in all probability, to the coarser sand in these filters. The per cent of wash water required has been approximately 5½ per cent with the new filters and 3½ per cent with the old. The higher per cent required for the new filters has been largely incidental to the tuning up process. In August the figures were 4.0 per cent and 3.0 per cent, respectively. In general the alum application has been at a rate of 0.9 grains per gallon and the soda ash at 10 p.p.m. The chlorine dose has averaged about 0.5 p.p.m.

Operation Results. — The combined filter plants have produced a clear, practically colorless and non-corrosive water. Turbidity has been reduced from about 3 p.p.m. to zero, and color from about 25 p.p.m. to 3 p.p.m. The pH of the delivered water has averaged about 7.0. Bacteria have been materially reduced. The average 20°C. gelatine counts per cubic centimeter have been about 500 in the raw water and 2 in the delivered water. The 37°C. agar counts have been reduced from 95 to 2 per cubic centimeter. The raw water usually contains organisms of the B. coli type in 10 c.c. inoculations and occasionally in 1 c.c. At no time has the delivered water given confirmed tests for these organisms. In brief, the Greenwich Water Company is delivering a safe and attractive water.

The new purification works were designed by Metcalf & Eddy, and constructed by Stone & Webster, Inc., with Mr. Carlton F. Green, construction superintendent. The Greenwich Water Co. is a subsidiary of the Community Water Service Co., of which Reeves J. Newsom is vice-president and chief engineer.

Acknowledgment.—The above is an abstract of a paper presented at the 1928 Convention of the New England Water Works Association.

Asphalt Paving Conference

Conflicting meetings have made it necessary to move forward the date for the Seventh Annual Asphalt Paving Conference to be held this year in New Orleans and, accordingly, the meeting will be held during the week of Dec. 3rd instead of that of Dec. 10th, as previously announced. The technical sessions will continue for three days, beginning on Tuesday, Dec. 4th, and continuing until Friday, Dec. 7th, when the conference will close with a golf tournament and the award of a number of handsome prizes to the winners. An exceptionally interesting and informative program of technical discussions and novel entertainment features have been provided. The Association of Asphalt Paving Technologists, The Asphalt Association, and the local committees are cooperating to make this conference even more successful than the six which have preceeded it.

For the first time in the history of the conferences, asphalt paving at airports will come in for thorough discussion. Among those who are expected to participate in the airport session are William P. MacCracken, Assistant Secretary of Commerce in charge of aeronautics; Col. H. H. Blee, Engineer for the Aeronautical Division, Department of Commerce, and several consulting or construction engineers prominent in the work of designing and building commercial and municipal airports.

The program will also present new and far-reaching economic and technical questions of vital importance to the good roads movement. The vast possibilities in the surface treatment of the many hundred thousand miles of roads that constitute the secondary highways of the country will be dealt with from the economical, technical and practical construction standpoint by a selected group of authorities headed by E. W. James, chief of the Division of Design, U. S. Bureau of Public Roads.

Radical strides in the development have been made recently in the mechanical equipment and operations involved in the construction of asphalt pavements and in the technique of asphalt construction, and these developments will be presented by men who have first-hand knowledge, including T. Warren Allen, Chief of the Division of Control, U. S. Bureau of Public Roads; M.

H. Ulman of the Pennsylvania State Highway Department; Prevost Hubbard, Chemical Engineer of the Asphalt Association, and others of equal authority and prominence.

Remarkable service results in the use of asphaltic concrete (black base) in California have induced the attendance of one or more prominent engineers from that state to present the results of their experience to the conference. Chris P. Jensen, County Engineer of Fresno County, California, one of the best authorities on this type of construction in the United States, is expected to present his experience with this type of paving.

Another feature of importance from the standpoint of practical first-hand information will be a series of papers by the heads of various state highway departments telling what results they have obtained with all forms of asphaltic construction and surface treatment. Seven of the states which have had wide and useful experience along these lines are Massachusetts, Michigan, Louisiana, Tennesse, North Carolina, Georgia and California, and also the Province of Ontario.

The first day, Monday, will be devoted to registration and committee meetings. On Monday evening there will be an open house reception arrangement. Light refreshments will be served. The Reception Committee will see that everybody becomes acqainted and there will be a few entertainment features to liven up the evening. Tuesday will be devoted to the opening morning session followed in the afternoon by a boat ride and inspection trip on the Mississippi River and Lake Ponchartrain, with the New Orleans Refining Co., as host. The asphalt technologists will meet in the evening. On Wednesday there will be morning and evening technical sessions and the afternoon will be devoted to a specially conducted trip to the race track where the Standard Oil Co. of Louisiana will be host to those attending the convention. On Thursday there will be morning and afternoon technical sessions. During the day a special social function is arranged for ladies, consisting of a luncheon with a talk by Dorothy Dix, and a trip through the French quarter of New Orleans. Thursday evening there will be a carnival ball with the Mexican Petroleum Corporation as host. This ball will be a replica of one of the famous Mardi Gras balls and will be held at the Athenaeum. The City of New Orleans will provide special street lighting and special details of police and firemen for this event. On Friday will be held the golf tournament.

A very strong local committee on arrangements has been created with John Klorer, New Orleans city commissioner of public property, as chairman. Mr. Klorer has charge of all paving for the City of New Orleans. He is also Vice-President of the American Society of Municipal Improvements and is an outstanding figure in municipal work in this country.

The local sub-committee chairman assisting in the arrangements are as follows: Committee on Entertainment Features, T. Semmes Walmsley, commissioner of public finance, City of New Orleans; Committee on Reception and Welfare, William T. Hall, commissioner of public utilities, City of New Orleans; Committee on Official Contact, Paul B. Habans, commissioner of public safety of New Orleans; Committee on Transportation, Walter Jahncke, president, Jahncke Service, New Orleans; Committee on Publicity, Harold Wright, aide to Mayor O'Keefe; Committee on Registration, Sam Fowlkes, manager, New Orleans Convention Bureau; Ladies' Committee, Mrs. George Penrose; Committee on Golf Tournament, Thomas Taylor, sales manager, Standard Oil Company of Louisiana; Committee on Special Features (1) Carnival Ball, W. R. Wilkinson, for the Mexican Petroleum Corporation (2) Boat trip, L. M. Law, for the New Orleans Refining Company (3) Race track party, H. C. Ehrenfels, for the Standard Oil Company of Louisiana.

A national Engineering Committee, upon which will appear the names of some of the foremost engineers in the United States, is being constituted under the chairmanship of Maj. J. M. Fourny, State Highway Engineer of Louisiana. A Research Committee is also being formed with W. J. Emmons, Associate Professor of Civil Engineering, of the University of Michigan, as chairman. The personnel of this committee will be selected by the Association of Asphalt Paving Technologists of the United States and Canada, of which Mr. Emmons is First Vice-President.

Presiding officers at the various sessions will include chairman, State Highway Commission of Louisiana; J. N. Holder, Chairman, State Highway Board of Georgia; Capt. H. C. Whitehurst, Assistant Engineer Commissioner of the District of Columbia; John M. Mackall, Chairman of the Maryland State Road Commission, and others.

Smoke Violations in St. Louis

During the month just ended thirty-one violations of smoke regulations were corrected by the city of St. Louis, Mo., according to a recently issued monthly report of Smoke Commissioner Gordon.

Of the violations thirteen were perpetrated by industrial plants, twelve by apartments and six by bakeries. Twenty-eight of the violations were corrected by a change from soft coal to coke as fuel, two violations were due to defective equipment, and one was caused by a low chimney.

Sanitary Service at St. Paul, Minn.

The city of St. Paul, Minn., has 426 miles of streets graded only, 215 miles of paved streets and 14 miles of paved alleys. The following interesting information on the sanitary services for these streets in 1927 is taken from the recently annual report of John H. McDonald, Commissioner of Public Works:

The paved areas—streets, bridges and alleys—amount to 4,957,954 sq. yd. Of this, 61 miles, or an area of 1,433,000 sq. yd., are cleaned by hand sweeping under the patrol system. The districts for each sweeper vary from 3,200 sq. yd. in the business district to 17,000 sq. yd. in the residential sections.

Snow removal, including sanding of walks and steps, amounted to $90,732, of this the street railway company paid as their portion $10,182.

In addition to the sweeping service, all paved streets are cleaned with water periodically. This is done with Studebaker flushers and auto flushers. One hundred and sixty-six miles of streets were flushed. In the retail district the streets are flushed every night. In the outlying districts flushing is done as required.

An interesting change has taken place in the matter of reducing the dust nuisance. In 1922 184 miles of streets were water sprinkled. During that year all street sprinkling on paved streets was stopped, the dust nuisance being taken care of by more frequent cleaning, thus removing the dirt which made the dust. One hundred and sixty-seven miles of paved streets are now flushed; 17 miles of dirt streets water sprinkled for the entire season and 259 miles of dirt streets treated with oil.

The rate for water sprinkling, four trips per day, was 12 ct. per frontage foot, or $4.80 for a 40-ft. lot, for the season. The rate for oiling, two oilings per season, an average width of 24 ft., was 5.28 cents per foot, or $2.11 per 40-ft. lot. The oil is distributed by Kinney auto oilers, using $1,020,000 gal. of road oil.

When dust was laid by flushing the following rates were used:

	Per Frontage Foot, Ct.
Night flushing, daily	14
Flushing every five days	2.5
Flushing twice a week	4
Flushing once a week	2

A total of 62,747 lots or parcels of land were assessed for sprinkling and oiling. Some of the lots were assessed for both, making a total of 95,140 seperate assessments.

During the year 49,776 lin. ft. of sewers have been flushed with fire hose. This required 4,750,000 gal. of water. The Water Department was reimbursed on a basis of 40 ct. per hour (459 hours) for the time hydrants were open during this flushing. The charge of 40 ct. per hour was based on an average of meter readings taken at various hydrants in this city.

The Control of Municipal Construction Operations

Check-Up Forms Used by Construction Engineers to Insure Good Workmanship and Proper Materials

By ARTHUR W. CONSOER

Consoer, Older & Quinlan, Consulting Engineers, Chicago

ONLY rarely are engineering designs or specifications found to be faulty on municipal projects. For most of the construction work undertaken by municipalities approved specifications and methods of design sanctioned by good engineering practice are easily available to the municipal engineer; and only occasionally is he called upon to make designs or write specifications for work that has not been, more or less, successfully standardized.

When difficult or unusual problems of design are presented they are usually properly worked out by competent designers, because engineering literature of recent years contains very few recitals of improper design on municipal projects.

However, examples of poor construction work are regrettably common on municipal work. In small villages and in some of our largest cities charges and counter charges regarding improper construction of public works appear frequently in the press and in political campaigns. Naturally many of the charges have no foundation in fact; and yet it must be admitted in the construction industry that cases of unsatisfactory construction are all too frequent in the municipal field.

Where bad management in the control of municipal construction operations exists it may be due somewhat to the fact that on most projects a comparatively small group of designing engineers is concerned with the preparation of plans and specifications and a much larger group of men is concerned with the supervision and inspection of the construction operations.

Ordinarily it is not difficult as a problem in management for the engineer in charge to insure careful and accurate designing of public works. The small group of designing engineers is usually free from the plagues of nepotism and political patronage. Tenure of office is usually secure for this part of the city engineer's staff. It is generally possible for the designing staff to develop an esprit de corps which makes impossible any unsatisfactory work in design or the preparation of specifications.

But on the construction operations with a much larger group of men employed as supervising engineers and inspectors, and with the contractors' selfish interests always present, a much

Date.....

Town..... Project.....

Subgrade.....Depth water mains below sub-grade.....

Location of weak spots and reinforcement[1].....

Quality of Materials.....Tests.....

Proportioning.....Bulking of sand[2].....

Cement count by inspector daily.....

Records of cement check.....Cast iron covers.....

Quality of mix.....Time.....

Water content.....Water meter.....Daily check.....

Joints .....Thickness.....Kind.....Straightness.....

High joints.....Truly vertical.....

Placing of joints as to curb dowels in block and at intersections.....

Do alley returns provide for drainage.....

Smoothness.....Straight edge.....

Slip dowels slip[3].....Curb dowels[4].....

Finish.....Hair cracks.....

Burlap on hand to protect against sun and rain.....

Parkways and cleaning up.....Steel end plates.....

Mesh required.....Used.....

Reinforcing steel.....

Sewer and water stubs in.....Extensions S & W in.....

Barricades.....General appearance.....

Cold weather precautions.....

Zero walks[5].....

Per cent completed.....Probable date of completion.....

Inspectors on slab.....On plant.....Have specifications[8].....

Construction record[6].....Record filed in leather roll[7].....

Remarks .....

Engineer.

Form I—Construction Report—Paving

Explanatory Notes:

[1]Location of weak spots in subgrade.

[2]Specifications provide for varying proportion of sand with actual moisture content as determined by daily tests.

[3]Slip dowel bars across transverse expansion joints are used. These dowels are three-quarter inch round smooth bars, provided with metal caps on each end and lubricated to provide for expansion and contraction. They must be carefully installed so that they slip and allow the joint to serve its purpose.

[4]Curb dowel bars are used with separate curb and gutter to dowel the curb and gutter section to the pavement slab.

[5]In some residential sections, warped intersections are built which provide for a zero curb exposure at the cross walk thus avoiding an objectionable step at the cross walk and providing a dry cross walk. This item in the report is a reminder to the inspector or construction engineer to check the plans for any intersection of this type which might be overlooked.

[6-7]The inspector's daily notes on quality and quantity of materials used, location, weather conditions and any other pertinent information. This data is compiled into a brief summary when the project is completed and filed with a complete set of plans in a leather roll for that purpose in the office of the clerk of the municipality. No project is considered complete until "yes" can be written in after number 7.

[8]A reminder to the construction engineer to ascertain if all inspectors are provided with a complete set of specifications.

Date.....

Town..... Project.....

Location .....

Subgrade .....

Quality of materials.....Tests of materials.....

Proportioning .....

Cement count by inspector daily.....

Quality of mix.....Time of mix.....

Thickness of base.....Top.....

Joints.....Finish.....

Curing.....Top placed.....Min. after base.....

Bank grading and berms.....

Cross slope[1].....Vertical curves[2].....

General appearance.....

Inspector.....Has specifications[3].....

Record of cement check.....

Construction record[4].....Record filed in leather roll[5].....

Per cent completed.....Probable date of completion.....

Remarks .....

Engineer.

Form II—Construction Report—Sidewalks

Explanatory Notes:

[1]Proper cross slope from edge of walk nearest the lot line toward the centerline of the street is necessary for drainage of the walk. This small item is sometimes forgotten by careless contractors.

[2]Appearance of vertical curves.

[3]See foot note 8 under paving (Form I).

[4-5]See foot note 6 and 7 under paving (Form I).

Curb and Gutter

Date.....

Town..... Project.....
Location .....
Subgrade.....Subgrade testing with rod[1].....
Quality of materials.....Tests.....
Proportioning.....Bulking of sand.....
Cement count by inspector daily.....
Quality of mix.....Time.....Honeycomb.....
Water content.....Water meter.....Daily check.....
Form settling.....Vertical curves.....
Joints.....1 in. on curbs.....Finish.....
Joints truly opposite.....Dowels.....
Curing.....Cutter drainage tested.....
Burlap on hand to protect against sun and rain.....
Reinforcing.....General appearance.....
Cold weather precautions.....Curbs backfilled.....
Per cent completed.....Probable date of completion.....
Inspector.....Has specifications.....
Zero walks.....
Remarks .....
.....

Engineer.

Underground Work[2]

C. B. construction[3].....Connections tested.....
Location .....
Inlets and connections.....Connections tested.....
Inspector.....Has specifications.....
Locations marked for paving inspector.....Sketches[4].....
Tests for depth of water mains.....
Sewer and water extensions in.....
Sewer and water stubs in.....
Gas and public service pipes and conduits in.....
Poles moved.....
Water valves in basins.....Basins drained.....
Per cent completed.....Probable date of completion.....
Remarks .....
.....

Engineer.

Form III—Construction Report—Paving for Curb and Gutter and Underground Work

Explanatory Notes:
[1]Subgrade is tested frequently for weak spots by means of a steel bar. These tests are usually made by the curb inspector and weak spots reinforced by steel reinforcing in the curb and gutter and pavement slab.
Other items in the report on curb and gutter are similar to paving items.
[2]Applies only to drainage work incidental to paving construction.
[3]Catchbasins.
[4]Showing locations of all connecting pipes for inlets and catchbasins as actually built.

Date.....

Town..... Project.....
Location .....
Size sewer pipe.....Required thickness.....Tickness used.....
Pipe laying.....Grade of stubs.....Stoppers.....
Depth cover.....Riser pipes braced.....Backfill tamped.....
Sidewalks notched[1].....Line level used[2].....
General condition.....Cleaning up.....
Size and weight of lead pipe.....Goosenecks blocked.....
Depth cover.....Length shut-off box.....
Type of shut-off box.....Elevation of top.....
Backfilling tamped.....Weight of brass fittings.....
Hydrostatic tests.....Water flow tests.....
Sidewalks notched.....Cleaning up.....
General condition.....
Per cent completed.....Probable date of completion.....
Inspector.....Has specifications.....
Construction record, locations, etc.[3].....
Record filed in leather roll[4].....Records on linen Atlas sheets[5].....
Final inspection made by field and construction engineers.....
Remarks .....
.....

Engineer.

Form IV—Construction Report—Sewer and Water Stubs

Explanatory Notes:
[1]Sidewalks notched for location of sewer or water service pipe.
[2]To obtain proper grade on sewer stub.
[3-4]Same as 6 and 7 under Paving, except that plan also shows exact location of each service as constructed.
[5]In some municipalities bound sewer and water atlases have been prepared on linen prints. The locations of all sewer or water stubs are posted in these atlases in lieu of filing a plan.

Date.....

Town..... Project.....
Location .....
Quality and size of cable.....
Height, dimensions, quality of posts.....
Proper equipment[1].....
C. P. or wattage of lamps.....
Laying of cable.....
Post foundations.....
Grade of posts.....Alignment of posts.....
Transformers.....Transformer basins.....
No sharp bends in cable in manhole.....
Individual transformer connection sockets filled with waterproofing compound.....
Proper size fuses or cutouts in group transformers.....
Construction record in leather roll[2].....
Per cent completed.....Probable date of completion.....
Inspector.....Has specifications.....
Remarks .....
.....

Engineer.

Form V—Construction Report—Electric Lighting

Explanatory Notes:
[1]This item covers such accessories as cut-outs, lightning arresters, time clocks, etc.
[2]Same as other records. It is important that exact locations of underground cables are known to avoid trouble on future construction.

more serious problem in management is presented to the engineer in charge.

Frequently the construction forces for supervision and inspection must be built up rapidly with many new supervising engineers and inspectors whose experience and integrity is still to be definitely determined. New men in an organization, even if possessed of excellent ability and previous experience are apt to interfere with the smooth and proper functioning of a construction program. Inspectors long in the service of a construction organization, particularly the political appointees, if there be such, are apt to slight important matters because of their very familiarity with such matters and the frequent occurrence of such matters on the job.

Construction work usually moves more rapidly than design work and the inspectors and supervising engineers are called upon to think more quickly and observe more sharply than is the case with the designers in the drafting room. The designer has ample time to review and check his designs and drawings but the inspector has usually lost almost all opportunity to review and check the construction operations, once they are completed according to a rapid profit making construction program by the contractor. The construction division of a municipal engineering organization is more apt to be troubled with political appointees and with political influence than is the design-division.

While the political appointee of insufficient experience and training is common as an inspector or supervising engineer in many municipalities where salaried staffs are employed, it is not at all uncommon for a consulting engineer in charge of municipal work to be requested to find employment for such men as inspectors. Probably the most difficult problem in management presented to the engineer engaged in municipal work is involved in the proper training and supervision of such political inspectors. Often such men can be trained and encouraged to do creditable inspection work. While they may enter the construction organization with little pride in the job and more or less without ambition frequently they can be imbued with a real sense of loyalty and will become just as jealous of the city's interests as men better qualified and better trained for inspection work. Where they cannot be so prepared for their duties, it is certainly incumbent upon the engineer in charge to cause their removal or to withdraw from the work itself. The latter action is decidedly the most difficult problem in management confronting the engineer engaged in municipal practice. However, unless he so manages such incidents he is bound to lose in professional prestige and in self-respect.

Various methods for improving the performance of inspectors and supervising engineers on municipal construc-

tion operations have been devised. Many municipal engineers, in an effort to obtain rigid inspection of construction issue manuals of instruction for the use of construction engineers and inspectors. The intent of such manuals is usually to standardize inspection methods and to assure a uniform high quality on the construction operations of the organizations. Such manuals are helpful in "breaking in" new men as inspectors.

Most organizations of this kind include one or more construction engineers whose sole duty it is to supervise construction and inspection. Such a construction engineer faces the problem involved in getting numerous inspectors disciplined to see things more or less the same and to obtain results or uniformly high quality on the construction operations. Specifications are often so lengthy and involved that the average inspector is apt to overlook some important items of the work unless a competent construction engineer confers with him frequently to check his performance on inspection of construction operations.

To assist construction engineers and inspectors in their work on a program of municipal construction work exceeding $12,000,000 of cost annually, check-up construction forms were devised by the writer and have been used successfully. The intent of these forms is to prevent lapses of memory as to important clauses of the specifications on the part of inspectors and construction engineers and to provide them with a definite schedule of things to do daily in inspecting each class of municipal construction work. These construction reports are not intended to supplant the specifications in any way, but have been used to supplement the specifications, and have proven very useful in improving the character of construction work carried on simultaneously in 37 different cities and villages in the Chicago Metropolitan Area.

Before preparing these forms for construction reports a record was kept for a year of the most common cases of oversight on the part of inspectors and the most common forms of complaint from property owners. The construction reports were then devised to prevent occurrence of such cases of oversight and complaint. During two succeeding years additional causes for oversight and complaint have been eliminated by necessary revisions in the construction reports.

The use of these construction reports has been very helpful in improving the quality of construction operations and has tended to make the operations of uniform quality in 37 different municipalities. Before commencing the use of these reports some of the inspectors were apt to consider themselves in the role of observers instead of in the role of inspecting engi-

Date.....

Town..... Project.....
Location .....
Quality of materials..... Tests.....
Cement count by inspector daily.....
Proportioning .....
Quality of mix..... Time..... Timing device.....
Water content..... Water meter..... Daily check.....
Calipering of mesh..... Tie wires.....
Placing of steel mesh.....
Shell thickness..... Trueness of internal diameter.....
Curing..... How done.....
Marking date of manufacture.....
Honeycomb[1]..... Dark ends[2].....
Reinforcing steel exposed[3].....
Sand streaks[4]..... Serial Nos. on rejected pipe.....
.....
Forms .....
Per cent completed..... Probable date of completion.....
Inspector..... Has specifications.....
Remarks .....
.....
Engineer.

Form VI—Construction Report—Concrete Pipe Manufacture

Explanatory Notes:
[1-2-3-4]These four items provide the most frequent causes for rejection of large concrete pipe and are therefore inserted to remind the inspector to watch for them particularly before accepting pipe.

Date.....

Town..... Project.....
Location .....
Size pipe..... Weight per ft. required..... Used..... Weight of fittings.....
Depth of cover below sidewalk grade..... Alignment.....
Hydrant setting..... Drainage of hydrants.....
Alignment of hydrants..... Grade of hydrants.....
Does grade of main agree with future paving grades.....
Tests..... Are valves opened after tests?.....
Final 24 hr. leakage tests.....
Backfilling..... Are valves opened and closed properly during tests?.....
.....
Construction record, mains, fittings, valves located—sketches, plans[1].....
.....
Valves—type and dimensions.....
Hydrants—Type and dimensions.....
Cold weather precautions.....
Pipes and hydrants all backfilled.....
Mains and hydrants flushed after completion.....
Flexible joint pipe under railroad tracks.....
Drain pipes cut and connected up[2].....
Cleaning up.....
Inspector..... Has specifications.....
Records filed in leather roll[3].....
Record on linen Atlas sheets[4].....
All new and old valves open after completion.....
Final inspection made by field engineer and construction engineer.....
.....
General conditions.....
Per cent completed..... Probable date of completion.....
Remarks .....
.....
Engineer.

Form VII—Construction Report—Water Mains

Explanatory Notes:
[1]The inspector's notebook showing exact location of fittings as installed, which notes are later transferred to the water main atlas.
[2]A frequent source of complaint on water main and sewer construction is failure to reconnect broken tile drains still in use.
[3-4]See previous foot notes.

Date.....

Town..... Project.....
Location .....
Size pipe..... Approximate cut..... Cradle.....
Cradle required[1]..... Cradle installed where required.....
Required thickness of pipe..... Thickness used..... Culling pipe.....
Age of concrete pipe..... Serial number on rejected pipe.....
Joints..... Kind[2]..... Using Jute..... Using.....
Condition of trench..... Width of trench specified..... Used.....
Is proper size joint material used?[3]..... Line level used.....
Pipe laying..... Batter-boards and top-line..... Gauge length.....
Gauge pole levels..... Foot check on gauge pole.....
Tamping ..... Cover..... Backfilling.....
Manholes ..... Materials..... Cones..... Covers.....
Manholes cleaned out..... Grade of covers..... Cleaning up.....
Infiltration tests..... Pumping.....
Catchbasins ..... Material..... Cones.....
Flow tests on catchbasins..... Tightness tests on catchbasins.....
Cold weather precautions..... Old services cut and connected up.....
Flow tests on sewers..... Mirror tests on sewers.....
Visual inspection of interior of large sewers.....
Per cent completed..... Probable date of completion.....
Inspector..... Has specifications.....
"Y" records[4]..... To date..... Walks notched.....
General condition.....
Construction record filed in leather roll[5].....
"Y" records on linen Atlas sheets[6].....
Final inspection made by field and construction engineers.....
Remarks .....
.....
Engineer.

Form VIII—Construction Reports—Sewers

Explanatory Notes:
[1]Concrete cradle for deep cuts. [2]Mortar or asphaltic compound.
[3]This applies if a preformed asphalt-jute gasket joint is used.
[4]Includes in addition to location of Y branches any other data as to details of construction.
[5-6]See previous foot notes.

neers with a fixed daily schedule of duties.

The inspectors are not required to fill in the report forms, but are instructed to use them as a guide or a memorandum. The construction engineers on their visits to the work fill out the reports, and in doing so make a very close check of the important items in the construction. These reports after being filled out are filed with other papers concerning the project and furnish an excellent record of the amount and kind of supervision and inspection on the project.

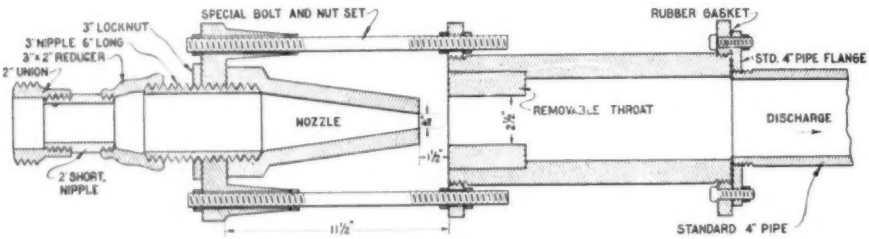
Reduction of Mud Balls in Filters

Mud balls forming in the sand bed at the Chain of Rocks filter plant of St. Louis, Mo., are disintegrated by jetting the sand from one end of the filter to the opposite end while wash water is applied to the filter. This is accomplished by means of a hydraulic ejector (Fig. 1). The pressure or nozzle end of the ejector is connected to provided with standard pipe fittings. a water plug with a 2½-in. water hose The discharge end of the ejector is fitted with standard pipe and fittings as required. The discharge pipe should be so assembled that it will act as a hanger for the jector, thus enabling the latter to be held in the floating sand at any desired depth. At the Chain of Rocks plant the discharge pipe is carried horizontally from the jector for a few feet, then with a 4-in. elbow and length of pipe the line is carried vertically, terminating in another 4-in. elbow and a long length of horizontal pipe extending toward the opposite end of the filter and resting on the concrete cross-beams. The vertical distance from the lower edge of the last length of the horizontal pipe to the edge of the spout on the ejector should be made such that, when the apparatus is hung on the cross-beams, the edge of the spout will be about 3 or 4 in. below the surface of the stationary sand. At the extreme end of the last length of horizontal pipe, the line is continued vertically downward for a short distance and there the discharge is reduced to 2½ in. with a 4x2½-in. reducer and a short 2½-in. nipple.

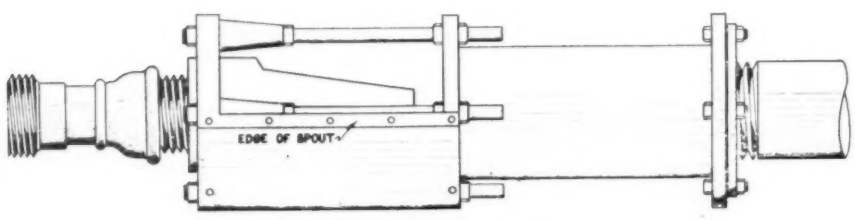
Under the discharge is placed a wooden box about 4 ft. high and 15 in. square, open at both ends and provided with three sloping screens, each 15x12 in. in plan. The screens are so arranged that one discharges onto another, while fastened to the top screen there is a small steel plate against which the discharge from the jector impinges. This steel plate tends to further disintegrate the mud balls.

Underneath this box there should be suspended a ⅛-in. mesh wire basket 2½-ft. square by 6 in. deep, the bottom of which should be a few inches above the overflow edge of the wash-water troughs. This will retain any small gravel that may come through the ejector. As fine gravel accumulates on this screen, it should be removed and scattered uniformly over the area of the filter while the wash-water is being applied. Without this screen fine gravel would tend to pile up underneath the box and cause an unevenness in the surface of the gravel bed.

When ready for jetting, the filter is first given a normal wash and then while the wash-water is still being applied, the apparatus is lowered into place. The rate of wash is then cut to about 5 gal. per sq. ft. per minute, which is continued for 15 minutes after which the rate of wash is momentarily raised to 10 gal. in order to level the sand bed. This increase and decrease of wash-water is continued every 15 min. for 5 hours, after which the apparatus is moved to the next filter. The amount of wash-water used during the 5 hr. period amounts to about 1,430 gal. per sq. ft. of filter area. The ejector may be moved about by four men.



SECTION OF JET ASSEMBLY



ASSEMBLY ELEVATION OF JET AND SPOUT

Fig 1—Details of Hydraulic Ejector

According to the last annual report of Leonard A. Day, Water Commissioner, by thus jetting the sand in the filters once every six months, the mud balls are very considerably reduced and part of the coating of the sand grains due to softening of the water is removed.

Wolf Diesel Engine Utmost in Simplicity

The Wolf compressorless stationary diesel engine, manufactured by the R. Wolf Co. in Magdeburg, Germany, and distributed in the United States by Morrill and Morrill, Sales Engineers, 30 Church St., New York City, is said to be a power unit that would prove particularly useful where the minimum of superintendence is available and where ability to use any of the heavier fuel oils is an advantage. This diesel is said to start easily by hand, requiring about four turns of the crank, and requires no supply of compressed air, cartridges, starting paper, or other means for starting, even when cold.

This is a vertical type engine and requires but little room for installation. There are no complex distribution gears, bevel wheels and pinions, shafts, gear rods and valve levers, nor mechanical inlet or exhaust valves, no compressor or scavenging air pump, no sensitive ignition devices, cables, and no carburetors to afford trouble. The machine is very simple and said to operate consistently for long periods and under heavy loads without a great deal of attention.

Complete information can be secured upon application to the distributors named above.

Piltometer Survey Results in Saving

A Piltometer water waste survey was recently made by Harrison Gray Otis, city manager, Rocky Mount, N. C., in his city, according to a report recently presented by him to his board of aldermen.

Briefly, in addition to the great value of a thorough inspection, and to the recommendations for improving the service, the report shows, among other results of the survey, a reduction in consumption amounting to 185,000 gal. per day, and an increase in revenue due to better metering of 45,000 gal. per day. These figures alone, which appear very conservative, according to his report, amount to a saving of $14.73 per day, or $5,376 per year, which capitalized at 6 per cent, equals $89,600. If the amount of money apparently due the city for use of unmetered water, and collectable is to be added, the report went on to state, the total cash value of the survey, from these items alone, appears to be over $100,000.

Comparison of Garbage Practice at Home and Abroad

An Interesting Account of European and American Methods

By FRANCIS L. PRUYN
The Decarie Incinerator Corporation, New York

IN the spring of 1927 the writer made a trip to Europe to inspect foreign incinerating methods in an endeavor to ascertain if improvements in our own apparatus and technique could not be made. It seemed reasonable to suppose, since Europe had incinerated its rubbish for a much longer period than the United States, that economies would be found that could be profitably adopted in our own country.

Conditions Different in Europe.—The writer visited incinerating plants in England, Italy, France and Germany and found the conditions governing all incineration entirely different from those found in the United States. Ashes are mixed with the rubbish, a condition which causes fundamental changes in the entire process. On account of economic conditions very little wood or paper is thrown away in the rubbish so that in order to produce sufficient heat for combustion it becomes necessary to include ashes which, with their high calorific value, will produce the necessary temperature.

The burning of ashes results in much higher temperatures than are required when complete odorless combustion is the only end in view. This can be obtained with temperatures ranging between 1,200 and 1,500 deg. F. The ashes produce a heavy clinker and as the common practice is to reduce this almost to a slag, temperatures are required in excess of 1,800 deg. F. In almost all instances the slag or clinker is utilized as a by-product, either by crushing for road material or by grinding and mixing with cement to produce brick. The furnaces are designed to conserve heat and with this in mind the charging, stoking and removing of clinker is done, as far as possible, without contact with the outside air.

In general the plants are more elaborate and more costly in design than those of the United States since the utilization of the by-products necessarily includes expensive apparatus and machinery. The waste heat from the furnace usually passes through high pressure boilers for the generation of steam before the gases reach the stack. The steam is either sold or used in the plant for its own operation as well as for the operation of the machinery required for the manufacture of the various by-products.

Incineration Plants in England.—In England the plants are largely of the type with which we are familiar in this country. They consist of high temperature brick incinerators and as their general design is similar to many plants now operating in the United States, the writer only visited the most modern plant in London, which was under construction at the time. This is situated at Fulham, a district of the City of London and consists of a new 200-ton incinerator. While the writer did not see the plant in operation he inspected a copy of the plans which showed a new system of double grates operated by hydraulic power. The clinker is scraped from one grate to the other without opening the furnace door and finally pushed out onto the floor of the furnace room without opening the doors of the furnace for stoking or other purposes.

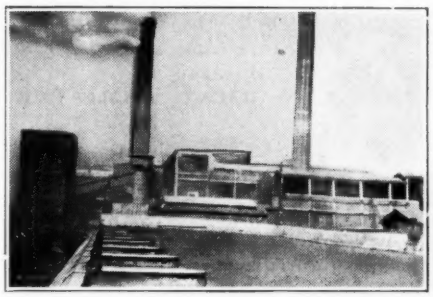


Fig. 1—View of Plant at D'Ivry, Paris, France

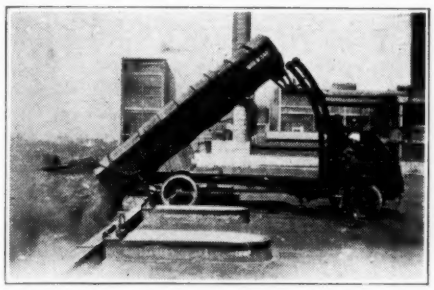


Fig. 2—Rubbish Truck Dumping Into Cars at D'Ivry Plant. The top of the Truck Is Closed with Steel Doors

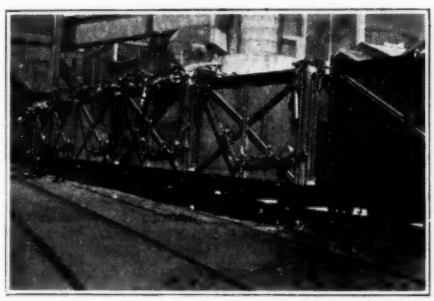


Fig. 3—Steel Dump Cars at D'Ivry Plant, with a Capacity of About 9 Cu. Yd. Each

The engineer in charge informed me that a contract had been entered into with a nearby electric light company to sell them steam at 500 lb.-pressure from boilers installed in the incinerator plant. The contract provided that a given quantity of steam was to be furnished every day in the year, and in order to insure fullfilment of this contract oil burners were installed under the boilers in case the incinerator had to be shut down for any cause. The revenue received from this power was about $25,000 per year which was enough to pay the interest on the investment in the plant. The plant is owned and operated by the city of London.

Paris Served by Four Plants.—Paris, with a population of approximately 3,000,000, is served by four incinerators which have a joint capacity of 143 tons per hour or a total capacity of 3,432 tons per day of 24 hours.

In the collection of refuse, ashes are mixed with the rubbish and garbage in order to obtain the necessary heat for combustion, and in all of the Paris incinerators various by-products are made from the clinker as in England. The plants are all of the high temperature brick type; the original English design having been modified to suit local conditions.

All incinerators in Paris, and I believe most of the public utilities, are operated on a joint ownership plan that is unique and interesting. The city pays for the plant and all improvements while a private company operates the plant and receives its pay from the sale of power, brick and other by-products, reserving for itself a fixed return on the capital invested as well as a fixed amount for overhead and salaries. The balance, if any, is paid to the city. The operating company is allowed to capitalize itself only up to about a 10 per cent basis of the total investment by the city so that payment of dividends on watered stock is avoided.

The writer visited two of the more recently constructed plants in Paris; one at D'Ivry and the other at d'issy Moullineaux. Both plants are enormous in area covering huge blocks and elaborate machinery equipment has been in-

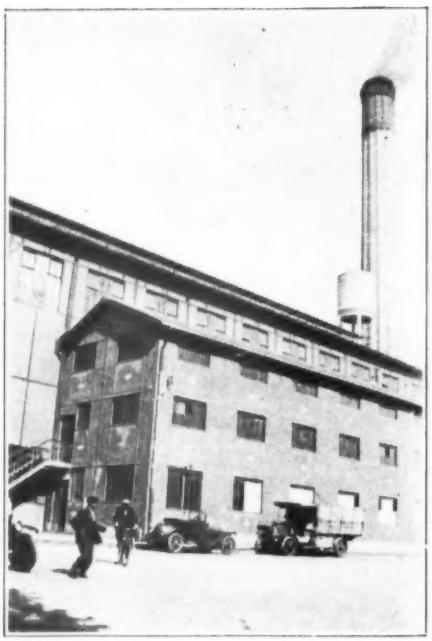


Fig. 4—General View of the Other Parisian Plant, at d'Issy Moullineaux, Showing Entrance from Street, Stack, and Administration Building

stalled both for handling the incoming rubbish as well as the clinker for the manufacture of cement brick.

At d'Ivry the rubbish is delivered in large covered motor trucks which back

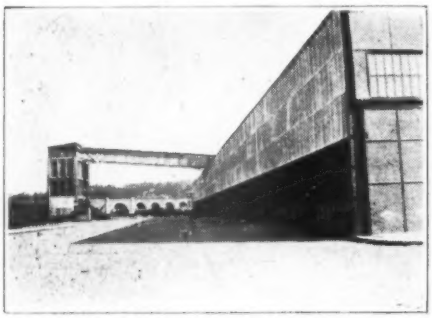


Fig. 5—Entrance for Trucks at d'Issy Plant. Trucks Dump Into Bin Running Full Length of Building, About 450 Ft. in Length. Car Runs Along Back of Bin. The Overhead Belt Conveyor Is Used for Fertilizer

up to a platform and dump into steel cars of about 9 yd. capacity. These cars are rolled into the incinerator; the removable bodies picked up by a crane and the rubbish dumped into a bin

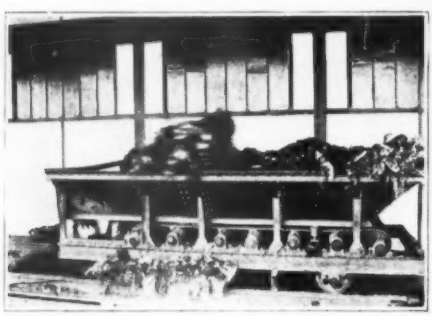


Fig. 6—Car Used in d'Issy Plant for Unloading Rubbish Onto Belt—Moves Along Storage Bin

where it is raked on to a belt conveyer and elevated to the top of the building.

As the belt travels through the building the picking out of bottles, rags, etc., is carefully attended to. The belt feeds the residue into a revolving screen where the dust is screened out of the mixture. This dust is chuted down into an adjacent building where it is bagged and sold as fertilizer. The residue is dropped onto the floors below through chutes and raked onto the brick arches of the furnaces by hand. When it has sufficiently dried it is raked down onto the burning grates. The clinker is pushed out by a hydraulic ram at the front of the furnace where it falls through openings in the floor to cars below.

After the clinker has cooled it is fed into two sets of grinders, then through one set of rolls and finally into the brick making plant. Here it is baked in steam heat for ten hours to get rid of the lime contained in the ash, mixed with cement and put through a brick making machine. The bricks are piled in the open yard and after setting are sold for 200 Francs per 1,000 brick. The price of the common brick in Paris at that time was 300 Francs per 1,000. The power for operating the d'Ivry plant is furnished by steam boilers utilizing the waste heat from the incinerators. The steam is transformed into electricity by means of steam turbines.

On the following day the writer visited the largest and most modern incinerator in Paris, which, as a matter of fact, was not entirely completed in some of its details but which was in full operation, nevertheless. This plant is located at d'Issy Moullineaux and has a capacity of 63 tons per hour. The plant is enormous in extent and contains some 60 high temperature cells, in addition to large drying and storage yards, brick manufacturing plant, high pressure boilers, steam turbines, electric generators, etc. There was no wood or street sweepings in the refuse but the material in general was much dryer than that found in the United States. The refuse is collected in covered trucks and dumped into a long bin running the entire length of the building. Here it is picked up by a traveling crane and dumped onto a movable bin at the bottom of which is a belt conveyer. As soon as the bin is loaded the belt conveyer under the bin is put in motion by its own individual motor and the material fed onto a long movable belt which runs the entire length of the building. The material is elevated through the building to the roof, the belt being picked over on the way for bottles, rags, etc. There the refuse is dumped into revolving screens and the dust chuted to a separate building where it is bagged and sold for fertilizer. The writer was informed, in this connection, that the price obtained from this fertilizer was very low and it was doubtful whether it paid to collect and sell it.

In the course of construction on the top floor of the building were two large cylindrical dryers through which it was proposed to feed the garbage in wet weather. The heat for the dryers was to be furnished by the incinerators.

After leaving the revolving screens the refuse is dropped into bottom dump buckets, which are moved by cable on a monorail on the floor below. From these buckets it is dumped into chutes to the charging floor and there raked by hand into the furnace through charging openings onto the brick drying arch. At intervals the material is raked off onto the burning grates and when the clinker is thoroughly burned the grate is revolved 180 deg. by electric motor which dumps the clinker without opening the doors of the furnace. This revolving grate is made of iron covered with fire clay—is solid without perforations. The hot clinker drops into metal cars which are picked up by a crane, dumped in a cooling yard where the clinker is watered by a hose until cooled off. It is then picked up and run through the crushers and rollers after which it goes to the brick making plant.

In talking with one of the city engineers in charge of incineration, and in reply to a question as to whether the elaborate machinery necessary for making brick paid, he stated that he thought they came out about even and

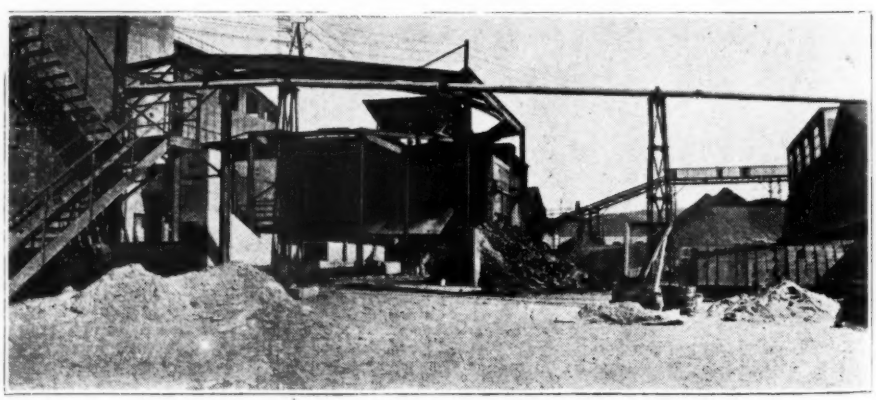


Fig. 7—Hot Clinker Is Dumped from Overhead Crane Operating on Monorail Grinders and Piles of Ground Clinker Are Also Shown

that it was worth while in an old and densely inhabited district such as Paris as it saved dumping space, that would otherwise be filled with clinker, for other purposes.

The maintenance charge on both of these Paris incinerators is heavy. Not only is the wear and tear on the type of machinery used heavy, but the brick furnaces have to be relined yearly. Very high temperatures are employed in the furnaces and when charges of wet garbage come in contact with the heater fire brick, rapid deterioration ensues.

German Plants.—The first plant inspected was at Frankfort, which has a population of 400,000. This is a large and elaborate plant of a high temperature brick type. I found it was shut down and had been since the close of the war, due to lack of funds for making the necessary repairs. During the four years of the war no repairs were made and the disintegration of this type of furnace is rapid and cumulative unless it is frequently inspected, and repaired when necessary. The furnaces had been removed from the incinerator building and the building itself rented to a manufacturer. Another reason given for shutting down the plant was the general use among householders of a coal substitute in the form of a low grade coal briquette. After the war coal became very expensive and the consumption of low grade coal in the form of briquettes contained few heat units and combustion could not be obtained in the incinerators without the use of coal. The ash from briquettes is also unsuitable for brick making and this is given as another reason for the discontinuation of many incinerators in Germany.

From the writer's observation at the dump where the rubbish is at present being disposed of, both at Frankfort and Weisbaden where the incinerator was also shut down, our American types of incinerators would easily have disposed of this material without the use of fuel.

The Frankfort plant manufactured brick and the waste heat from the incinerators was also used for the drying of screenings from the sewage treatment plant which occupied a portion of the same building. The dried screenings were sold for fertilizer. This is a very interesting feature of this plant and one that should be copied wherever practical in the United States. Screenings are a very difficult material to dispose of, but if they can be dried or mixed with refuse and burned in an incinerator the process is greatly simplified.

Closed trucks are used for the collection of rubbish and these are supplied with a removable cover that exactly fit the collection receptacle left with the householder so that the garbage does not come in contact with the air in the process of dumping into the truck. This is a carefully worked out German idea which is entirely too elaborate for American practice.

The Weisbaden plant was also shut down for the same reasons governing the abandonment of the plant at Frankfort. The furnaces had been removed and the building had been rented to a foundry. At the dump some interesting trucks and trailers were observed. One in particular containing a worm gear which lifted the rubbish to the high part of the truck from the ground level.

The incinerator at Furth, formerly one of the show plants of Germany, was also shut down and the building used for other purposes.

The writer was informed that a new large plant is under construction at Cologne. This is a very elaborate design and considerable revenue is to be obtained by the manufacture of brick from slag.

Another large incinerator plant is in operation at Berlin but this was not inspected.

Plants in Beccari, Italy.—The next plant inspected by the writer was the Beccari plant at Florence. Florence has a population of 250,000 and the garbage and rubbish is handled in this plant of 200 cells. The cells are of concrete, contain about 1,000 cu. ft. of garbage and are furnished with suitable drainage sumps and ventilating cuoplas. The collected material, consisting of rubbish and garbage, is dumped on the floor of an outer shed where the rubbish is picked out. There seemed to be very little rubbish in this material. The garbage is comparatively dry, very different from that produced in America, and probably contains not more than 20 to 25 per cent moisture. It is loaded into the cells by hand, and wet down with the sump liquid that has drained from some of the other cells. The doors of the cells are then closed and the fermentation process begins. After a period of a week or ten days the temperature rises to about 150 deg. F. After a digestive period of from four to five weeks the cycle has been completed, the temperature drops to about 100 deg. F. and the material is removed. The humus as it comes out is a dark brown practically odorless mixture which has high fertilizer value. It is screened and sold for fertilizer, the finer grades at about $7.00 a ton and the coarser ones at from $3.00 to

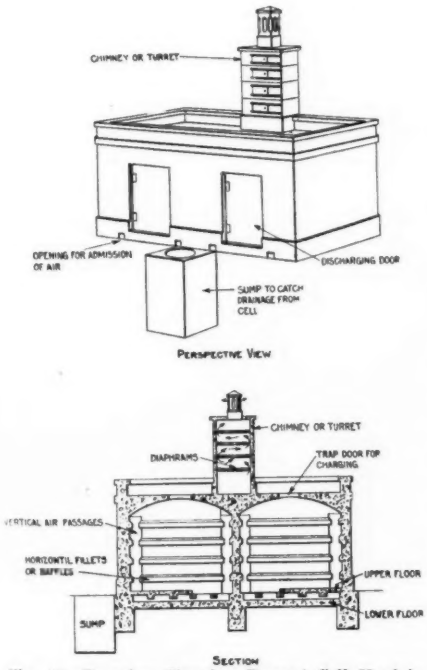


Fig. 12—Drawing Showing Beccari Cell Used in Florence and Scarsdale Plants

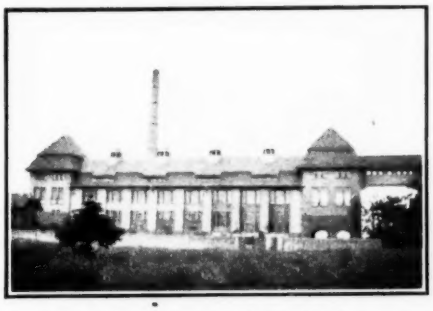


Fig. 8—General View of Frankfort Plant

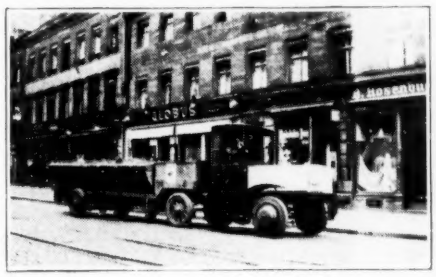


Fig. 9—Collecting in Frankfort Is Done with These Trailers Equipped with Covered Buckets

Fig. 10—Old Type of Collecting Truck at Dump in Weisbaden

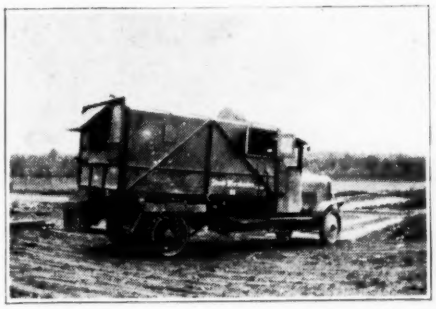


Fig. 11—Another Type of Truck Used in Weisbaden. Rubbish Lifted Into Body by Worm. In Unloading, the Body Tilts 70 Deg.

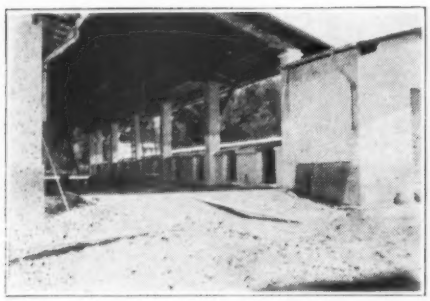


Fig. 13—A Beccari Plant at San Remo

$4.00 per ton. One or two of the cells have been fixed up with stacks to be used as incinerators and the collected rubbish is burned in these cells. The plant at Florence is operated by private contract, a contractor takes the material at the plant, the collection being done by the city.

The next plant inspected was also a Becarri plant at San Remo which is a small winter resort on the Italian Riviera. This is the latest design of the Becarri Company and differs considerably from the Florence plant in that the cells are somewhat smaller in area and less in height and the ventilating system is entirely different. The cell walls are constructed of hollow tile arranged with proper openings for the free circulation of air into the interior of the cells and it is claimed that this plant is more efficient than the type used in Florence. The plant had just been completed at the time the writer visited it but was not yet in operation.

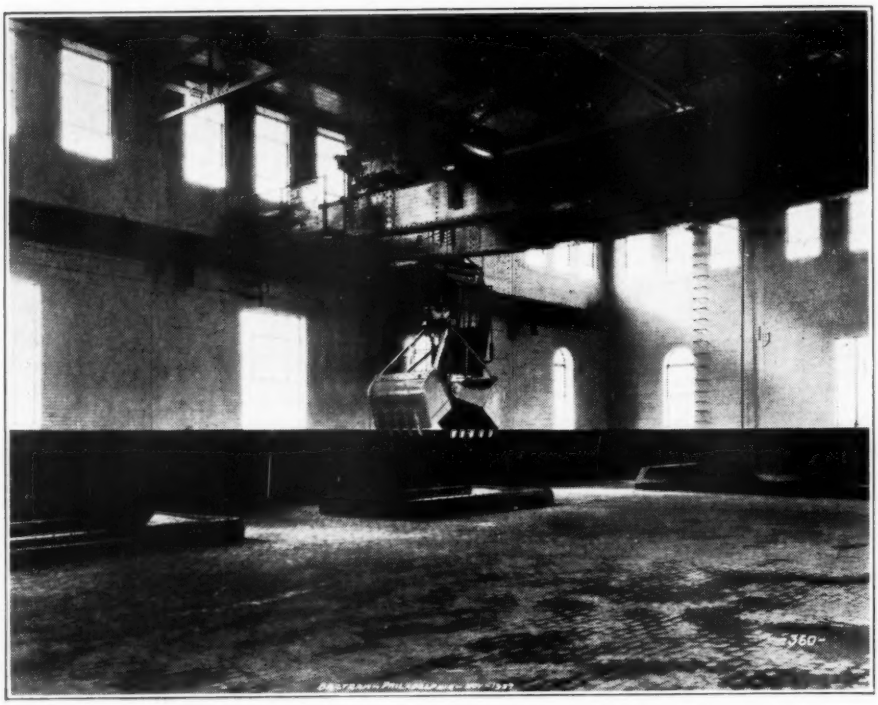


Fig. 15—Clamshell Dumping Refuse Into the Furnace at the Philadelphia Plant

Becarri Plants in United States.—On the writer's return to this country, he was so impressed with the design of the Becarri cells in San Remo that two

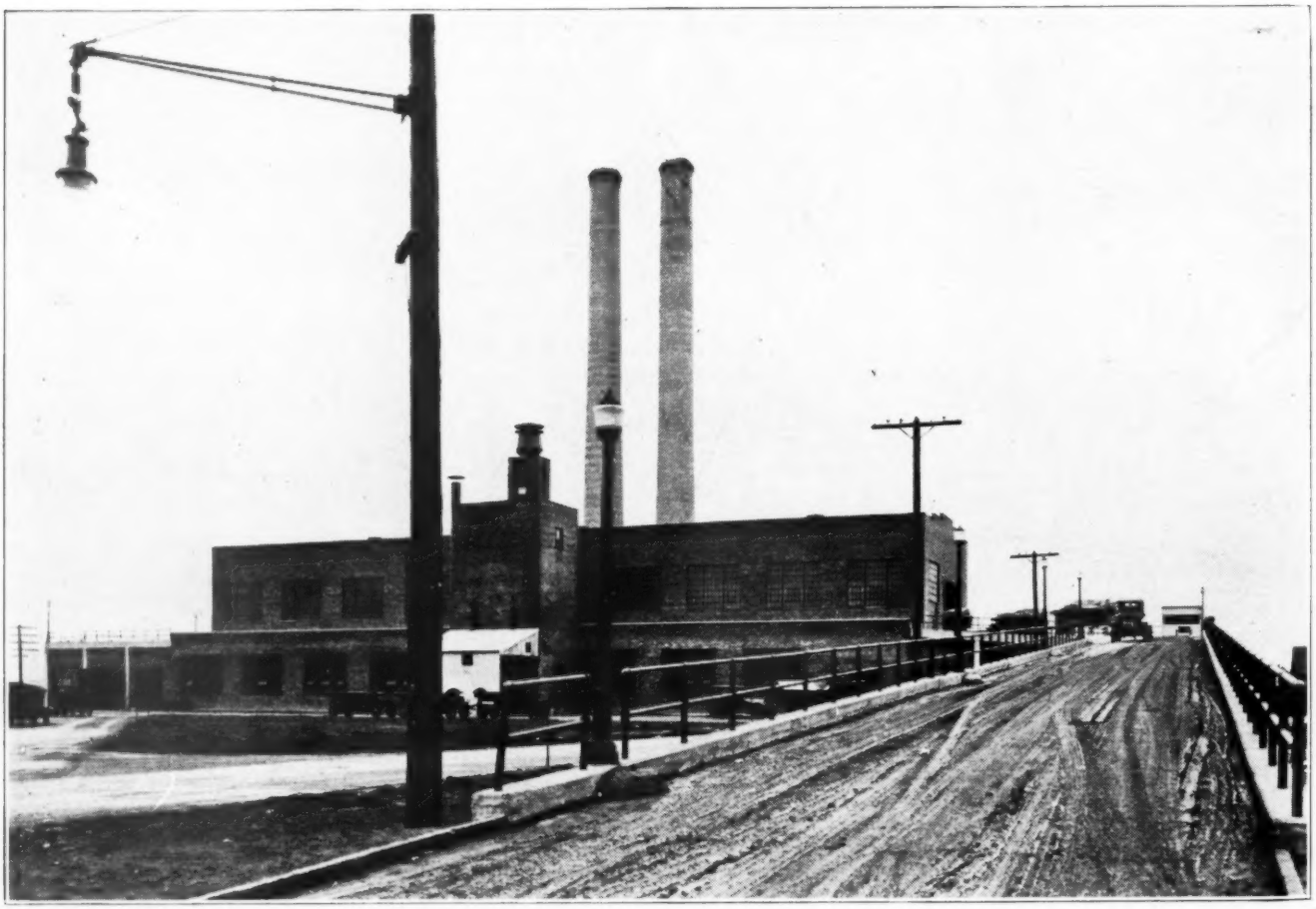


Fig. 14—General View of Heenan Froude Multiple Cell Type Plant at Buffalo

experimental cells were built in Long Island City near out field office where observations were taken during the fermentation of the garbage in these cells. Owing the fact that American garbage contains 85 to 90 per cent moisture, cells 10 ft. high, such as used in Florence are not adaptable to the treatment of this wet material. In the experimental cells horizontal trays are inserted at about 30 in. centers and the garbage placed upon them in layers not exceeding 24 in. in thickness. The cells are built of hollow tile, separated by a ¼ in. opening one from the other. An opening at the front is so arranged that the air can circulate entirely around the cells.

Both cells were filled with garbage, one being treated with about 5 per cent lime mixture and the other without. At the end of 30 days the fermentation process was completed, the material was practically dry and odorless and ready to go to the grinder to be reduced to commercial form, bagged and sold. In the adjacent town of Scarsdale, N. Y., where this process has been in operation for some time this same system of shelves has been installed with similar satisfactory results. The material is ground after remaining four or five weeks in the cell and sold to farmers who come and load it, for $20 to $25 a ton. It is self-evident that if anything approaching the above mentioned prices can be obtained for the ground humus the plant will pay for itself in a very short time. It is necessary to install a small incinerator at each plant to take care of the papers and other rubbish that is collected.

Incinerators in the United States.—A description of a few recent installations of incinerators in the United States will be of interest, showing as it does how much more simple the design becomes when the manufacture of by-products such as cement brick is dispensed with.

The recent 500-ton plant at Buffalo is a Heenan Froude, high temperature multiple cell type. The refuse is dumped from the collection truck into storage bins. Clamshell grab buckets operated by overhead traveling cranes pick up the refuse from the bins and load it into the furnaces as needed. The plant is operated in three shifts of 8 hours each.

A 200-ton Decarie incinerator was built in 1927 in Philadelphia. This plant contains two large storage bins—one on each end of the building—into which the refuse is dumped and from which it is handled by a clamshell bucket and overhead crane into the furnace.

A test at this plant by the city of Philadelphia showed temperatures in the combustion chamber in excess of 1,800 deg. F. with an average of about 1,500 deg. during the test period.

In the city of Providence, R. I., a 160-ton Decarie plant was built in 1927 which contains one novel feature in the

Fig. 16—General View of Philadelphia Decarie Plant

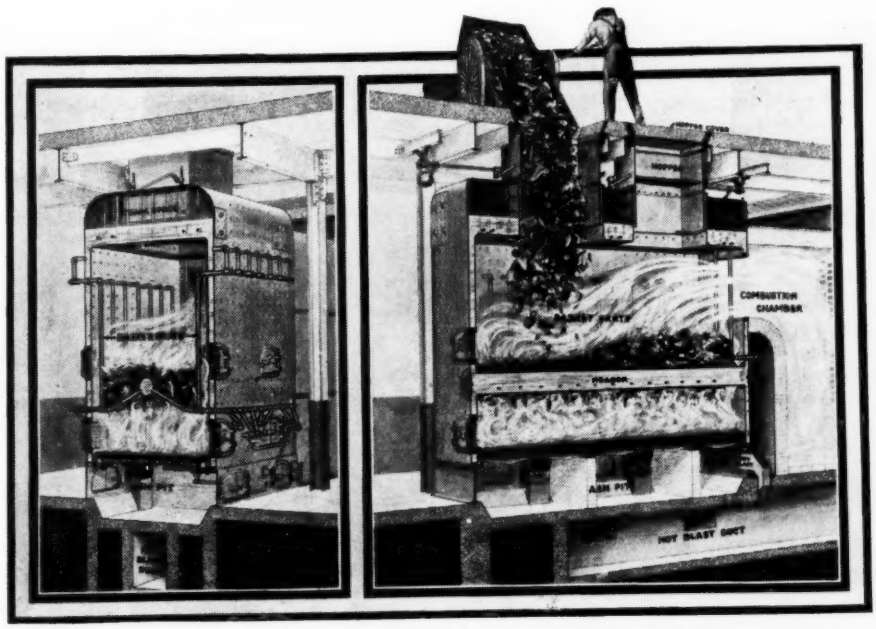


Fig. 17—Drawings Showing the Design of the Decarie Water Jacketed Furnace

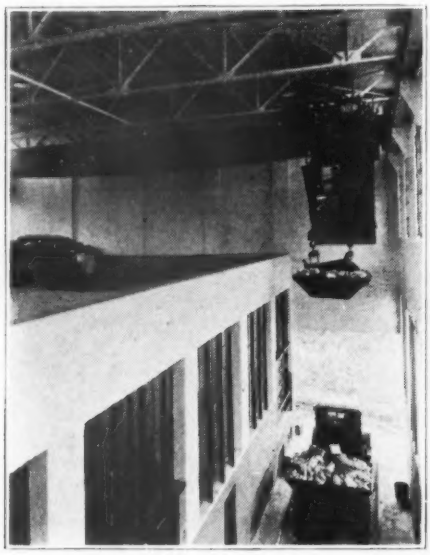


Fig. 18—Unloading Containers from Trucks at Providence Plant

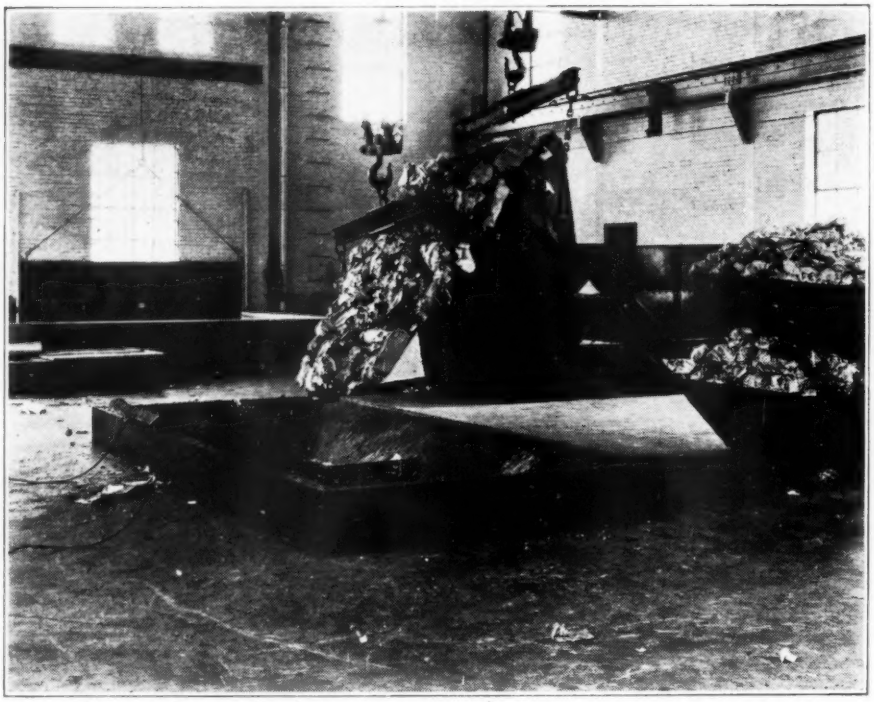
handling of the refuse. Removable steel containers are used on the collection trucks which are handled directly from the truck by an overhead crane into the furnace. During the collection period the excess containers are stored on the charging floor of the incinerator and dumped into the furnace as required on the succeeding shafts. By this method the rubbish and garbage is not moved from the original container in which it has been collected until it goes into the furnace and is, therefore, one of the most sanitary methods of collection that has been devised.

The Decarie furnace is of steel water-jacketed construction. It also contains a tubular water-jacketed basket into which the rubbish is dumped and from which it is raked onto the second burning grate below. The production of steam in this furnace is approximately 1 lb. of steam per pound of refuse burned.

The American engineer in studying the problem in his own country might well copy the economics effected in European practice through the utilization of the waste heat now escaping through our chimneys at temperature around 1,000° F.

The tendency in American incinerator practice today is for larger units, crane fed with 24 hour operation. This mechanical equipment requires considerable power to operate it and by the installation of steam boilers and electric generators, a large saving can usually be effected. Combustible refuse is plentiful in most American cities. The result is high furnace temperatures and the loss of quantities of energy that can economically be put to use in the operation of the incinerator plant.

Quite recently the secifications of a 225-ton capacity crane operated incinerator contained a guarantee clause



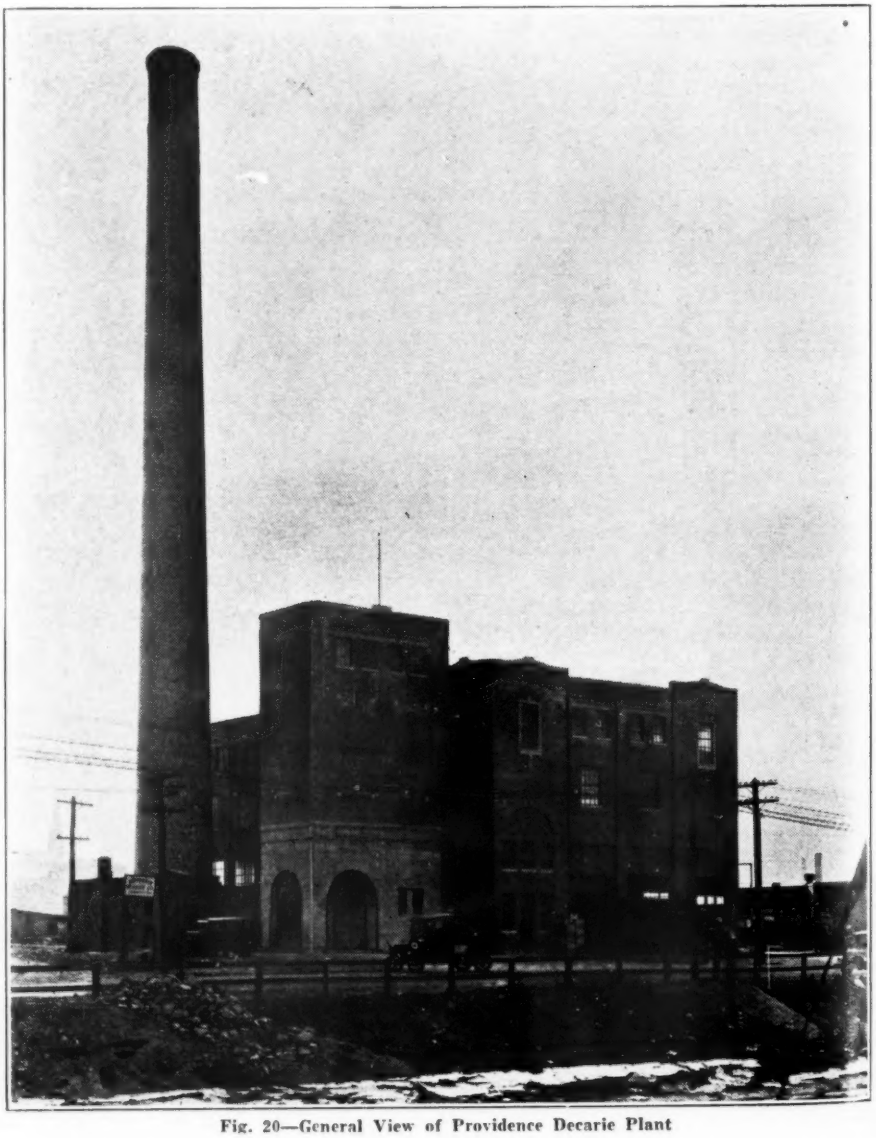


Fig. 20—General View of Providence Decarie Plant

stating that the consumption of electric current for plant operation would not exceed 3.37 kilowatts per ton of capacity. Electric current costs 3½ ct. per k. w. in this city so that the yearly bill for power will be $8,200. This amount capitalized at 4½ per cent equals $182,000. As the cost of the power equipment to operate this plant would only cost a fraction of this amount a considerable saving could be effected by its installation.

Acknowledgment.—The foregoing is a paper printed at the 58th annual meeting of the American Society of Civil Engineers.

Paved Street Maintenance at Los Angeles, Calif.

The repairing and resurfacing of asphalt, macadam and other bituminous pavements in Los Angeles and the replacement over excavations made by utility companies is handled by the Maintenance Division of the Engineering Department of the city. The following details of the work during the fiscal year ended June 30, 1927, is taken from the annual report of the Engineering Department of which John C. Shaw is City Engineer.

Several methods are used in the maintenance of paved streets: The surface heater process, resurfacing by cover process and by the patch process.

The surface heater process is to heat the surface and remove part of old surface so that new material may be added; the average mixture which is added is 1¼ in. This method has been employed since 1917 and many of the main thoroughfares have been resurfaced, causing very little inconvenience to the traveling public.

The cover process is used mostly on the highways and streets where it is not necessary to remove any of the old surface and where the cross section of the old streets will stand added material; this process is to clean the streets, apply liquid asphalt as a binder and rake and roll new mixture over old surface. This method has been used for the past 14 years and has been very satisfactory.

The patch process used is to cut out the worn-out places where the base has failed.

The personnel of this division during the past year consisted of 1 superintendent, 1 assistant, 1 truck dispatcher, 9 foremen, 9 engineers, 1 watchman, 20 asphalt workers, 8 heater workers, 45 laborers, 8 city-owned trucks, and 21 contract trucks. These are divided into 9 gangs, 1 heater crew, 6 re-surfacing crews, 2 small crews on special work and patching, and 1 crew is used in pouring cracks in concrete pavements. Notwithstanding the added territory and additional work this division is called upon to do, less personnel was allowed than during the previous year.

The materials used by the street replacing divisions during the current year, which were produced by the two Municipal asphalt plants, was 98,988 tons of various asphalt mixtures and 16,090 tons were purchased from private plants.

The following table indicates the area of each class of work placed and the cost per sq. ft.:

The street replacing division records show that 1,583 jobs were outstanding at the close of the last fiscal year, which were all completed during the early part of the year. The number of work orders received during the current year was 64,462, of which 62,327 have been executed, making, in conjunction with the orders outstanding at the first of the year, 64,841 work orders executed during the current year and 2,135 not yet completed. The average daily number of jobs completed was 224.

Below is given a tabulation of the area of each class of surface replaced during the year, followed with the cost per unit. The data given is exclusive of those for San Pedro, Wilmington and the San Fernando Valley:

The charges for all work performed are made at the following rates:

The working force of this division during the current year, has consisted of 1 superintendent, 3 clerks caring for the work in the office, 2 foremen in charge of the asphalt and concrete work, who at present are responsible for 2 asphalt foremen, 1 roller engineer, 11 asphalt workers, 73 laborers, 3 city-owned 2-ton trucks, two of which are used for emergency patch work, and 19 5-ton contract trucks.

	Area Sq. Ft.	Cost Per Sq. Ft.
Resurfacing with surface heaters	3,062,284	$.0564
Patch repair work	716,449	.1118
Cover repair work	1,441,528	.0665
Resurfacing by cover process	2,282,750	.0477
Reconstruction of paved areas	311,902	.0744

	Per Sq. Ft.
Replacing asphalt pavement base and surface	$ .40
Replacing macadam pavement	.30
Replacing brick pavement	.40
Replacing granite block	.30
Replacing oil gravel	.12
Replacing streets not oil graveled or paved	.01
Replacing sidewalks	.28
Replacing concrete street pavement	.30
Replacing curb, per lin. ft	.50
Replacing asphalt only	.18
Replacing concrete only	.22
Replacing prospect holes, each	.15
Replacing stake holes, each	1.00

Class of Service	Area Sq. Ft.	Cost Per Sq. Ft.
Asphalt paved streets	482,902	$ .3816
Macadam	23,773	.2871
Brick	3,148	.8111
Concrete	127,319	.4377
Sidewalk	42,816	.3544
Curb, lin. ft.	314	1.08
Granite block	3,200	.6418
Asphalt only	7,356	.2136
Oiled gravel	1,180,205	.0944
Dirt streets	1,420,090	.0006

Tax Increase in Massachusetts Town

The tax rate for Westfield, Mass., for this year was formally announced on Sept. 3 as $33 on each $1,000 of assessed valuation, an increase of $1 over the rate last year. The 1927 rate was an increase of $1 over that of the previous year.

A $300,000 bond order for a new high school is involved.

Unusual expenditures this year are in the main responsible for the increase, there being $31,000 appropriated for repairs and alterations to the present high school plant and $20,000 for the construction of a concrete bridge at Little River to replace a structure which collapsed last Fall. The valuation of the city was increased nearly $500,000. Reductions in other taxes made it possible to keep the rate at the figure reached.

City Planning and Zoning

The U. S. Bureau of Standards has received from the printer the "Standard City Planning Enabling Act," Building and Housing Publication No. 11. This act was drafted by the Advisory Committee on City Planning and Zoning in response to many requests for a standard act which might be used by the various States in enacting city planning legislation. It covers the four general subjects which experience has shown to be a necessary part of planning legislation; namely (1) the making of the city plan and the organization and powers of the city planning commission, (2) the control of subdivisions, (3) the control of buildings in mapped streets, and (4) regional plan and planning commissions. Copies of this publication may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 ct. each.

How Rock Asphalt Tennis Courts Were Constructed at Shelby Park, Louisville, Ky.

By WM. CALVERT
Engineer in Charge of Construction

Tennis courts with rock asphalt surfaces have been constructed recently at Shelby Park, Louisville, Ky. The base was built of limestone rock laid in two courses and each course thoroughly choked with screenings and rolled until a stone laid in front of the roller was crushed instead of being rolled into the base.

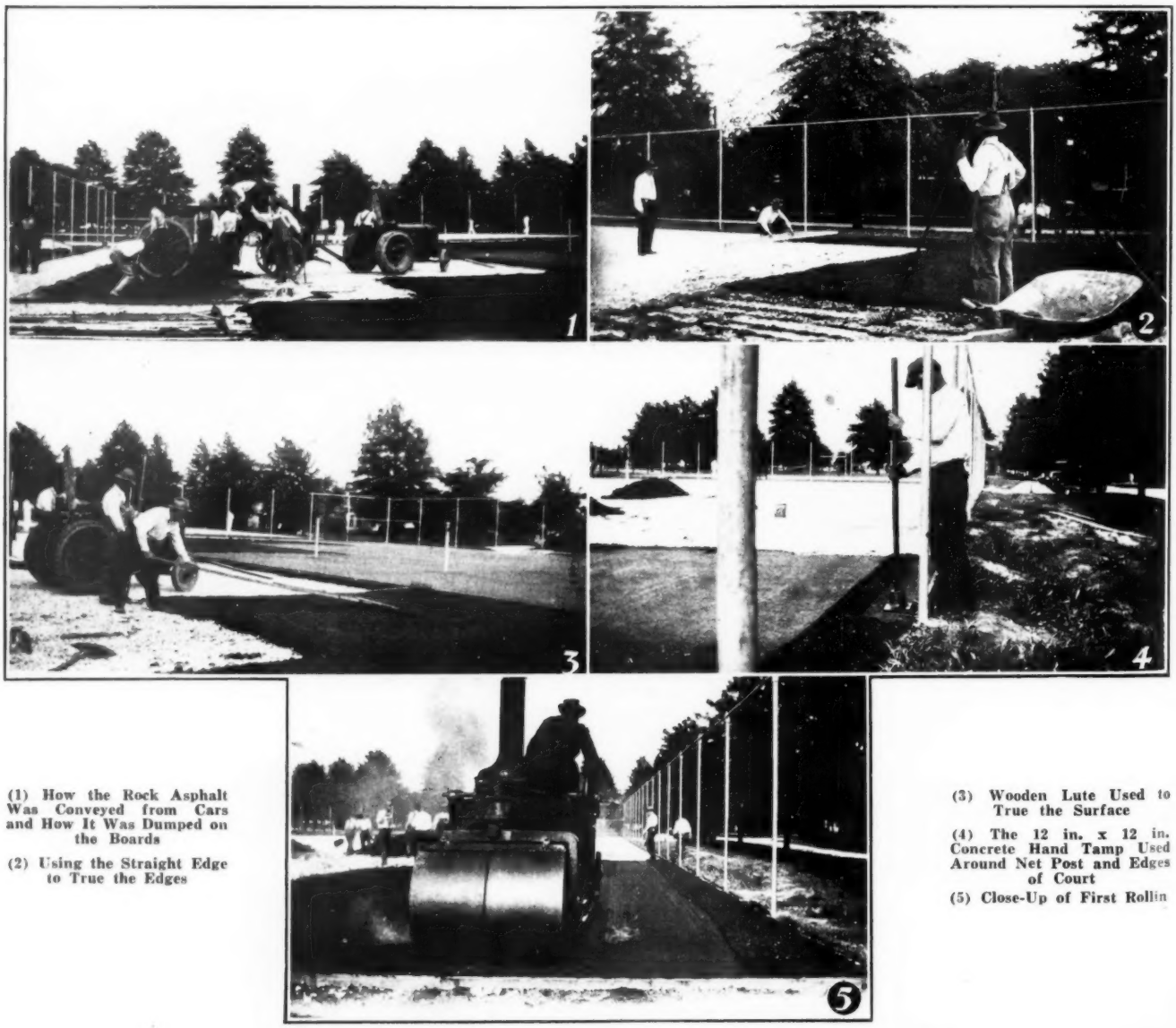
After the courts had been laid out with grade stakes for the loose thickness of the rock asphalt, irregularities were sought in the base and corrected. Replaced rock was again screened and rolled. The courts had two broomings, two rollings, before they were pronounced ready for the rock asphalt.

The Kyrock was dumped from Fordson tractor trucks on to boards laid on the rock base. Shovels were used to spread it and large tine rakes were used to smooth it off.

A straight edge was used to level two sides of each section to the true grade and a 6 ft. wooden lute was used to make the center correspond to the sides.

At the end of each day the loose Kyrock was rolled. A concrete hand tamp was used to tamp the edges of the court and around the net posts. After the whole area had been rolled once, the roller was run the opposite direction to roll out any waves which had shown up from the previous rolling.

A straight edge was laid in all directions in each section to find depressions and they were filled with Kyrock sifted in a ¼ in. sieve, also any of the surface that was honeycombed was corrected the same way. This was then rolled and then the whole court was given its final rolling.



(1) How the Rock Asphalt Was Conveyed from Cars and How It Was Dumped on the Boards

(2) Using the Straight Edge to True the Edges

(3) Wooden Lute Used to True the Surface

(4) The 12 in. x 12 in. Concrete Hand Tamp Used Around Net Post and Edges of Court

(5) Close-Up of First Rollin

Constructing Tennis Court at Shelby Park, Louisville, Ky., with Rock Asphalt Surface

Water Softening Plant at Marion, Ohio

Paper Read Before the Central States Section of the American Water Works Association

By GEORGE WHYSALL

Vice-President and General Manager, The Marion Water Co., Marion, Ohio

I HAVE been asked upon numerous occasions why an attempt had been made at Marion to soften water supplied by wells and having a total hardness of from 40 to 51 grains per gallon, and if consideration had not first been given to another source of supply.

In the first place, a considerable sum of money had already been expended in the drilling and equipping of wells with the object of securing an ample supply of water from the limestone underlying the greater part of the district surrounding Marion. This water is and always has been of an exceptional character and no trace of typhoid has ever been found to have originated from the use of limestone water furnished by The Marion Water Company. Second, there is not available to the plant a river supply sufficient to take care of the requirements, about 2½ to 3 M. G. D.

Storage.—The softening plant as designed, contemplates a detention period long enough to drop out the maximum quantity of silt which is carried by a stream about three miles distant from the plant, the latter having a normal flow greater than the Marion requirements for some time to come.

As the plan worked out, we have two million gallons in the two basins and two million gallons in each of the two large tanks, so that there is available practically six million gallons, plus the combined capacity of the deep well pumps, four million gallons daily.

Variable Hardness.—A two years study was made of the different wells with the result that there was found a surprising difference in the water produced, and the next discovery was that wells after several days shut-down, produced a much harder water than when in continuous operation. This peculiar condition continues and no satisfactory reason for the irregular hardness of the water has been had.

We find that some wells are more consistent than others in that they produce a uniformly softer water than others. Consequently we have had to develop a schedule for well operation, bringing into service, first, those producing the softest water, and as the demand on the plant increases, the next hardest wells are, in turn, brought into operation.

Lime-Soda Treatment.—In the selection of the proper type of softening plant, it is essential to determine the ratio of carbonates of lime and magnesia to the sulphate hardness, which in our case is about 50 per cent. It was, therefore, concluded that the so-called lime-soda process should be adopted with provisions made for the future installation of green sand (Zeolite) filters for the purpose of eliminating the soda ash treatment and the substitution of the green sand, salt regeneration method. Estimates have been prepared covering this substitution treatment which indicate some saving, water could then be delivered at zero hardness, or by remixing, at any total hardness desired.

Basis of Design.—We determined, before making the preliminary plan, to call in, for consultation, a widely known chemical engineer (Charles P. Hoover), one who was already familiar with some of our problems. The chemical end of the problem being worked out, it then became a matter of determining the capacity of the plant, 5,000,000 gal. daily, and the sequence of the several parts making up the unit. The chemical house was first designed and instead of housing the two chemical storage tanks and supporting them on the walls of the building, we made the supports independent of the building and on their own foundations. These storage tanks are 16 ft. in diameter and 30 ft. high and will hold 215 tons each. They are closed over tightly at the top and project throughout their entire length above the roof of the chemical house. The bottom ends of these tanks are funnel shaped, provided with a hand operated slide gate which permits the material to be dropped directly into the weigh hoppers beneath. The tops of the weigh hoppers and the bottom of the tanks are connected with a muslin skirt or tube, which prevents the dust of the materials from escaping into the room.

Feeders and Slakers.—Immediately under the weigh hoppers are the Browning feeders and slakers. The feeders and slakers are motor-driven and are supplied with water to an extent which does not permit any increase of temperature through the slaking of the lime. The lime and soda ash solution are removed from the slakers and forced into the mixing tank by means of a water ejector.

Mixing Tanks.—The mixing tanks are 30 ft. in diameter, 30 ft. 8 in. high and are so arranged that they may be operated in a series or parallel. The water enters the mixing tanks on a tangent, thereby assisting the stirring mechanism to a considerable extent in the movement of the water. The stirring mechanism consists of paddles attached to the lower end of the vertical shaft and are set to operate quite close to the bottom. The weight of the vertical shaft and the driving mechanism is supported on ball bearings attached to a bridge extending across the top of the tanks. This bridge also carries the reduction gear and variable speed motors. There is but slight difference in velocity between the movement near the center and circumference of the tanks and speed of mixing is adjustable.

Dip Pipe Feed.—Originally the lime solution was to be introduced through a nozzle on the tangental feed pipes. This method has been abandoned on account of the coating and clogging of the nozzle, which was 2½ in. in diameter, and the substitution therefor of a 6-in. dip pipe which carries the lime solution over the top of the tank and down to a point in the zone of the feed pipe discharge. The soda ash solution is discharged through a dip pipe extending down about half way in the mixing tank. We have introduced the soda ash solution at different points in both mixing tanks, but practice indicates that both the lime and soda ash solutions should be introduced in the first tank, the latter at a point far enough above the lime to permit the lime reaction to become complete before the soda ash makes contact. This tends toward more uniform effluent of the second tank as well as a better floc. As an experiment, we tried the introduction of a very small alum dosage introducing same into the mixing tank with the soda solution. This had a tendency to thicken the floc, but later we discovered a much better point for the introduction of the alum solution, .20 to .25 grains per gallon.

Effluent.—The effluent from the second mixing tank is carried through a 48-in. off-take which is supported from the bridge carrying the Dorr thickener or clarifier, and delivers the effluent into the feed-well of the clarifier tank. This feed-well is also supported from the bridge, is 30 ft. in diameter and extends from above the surface of the water to a point within 10 ft. of the bottom. Due to the extreme low velocity of the water on its way from the mixing tanks to the clarifier feed-well, a distance of 60 ft., the floc is fairly well settled toward the bottom of the off-take pipe by the time it reaches the feed-well. The turbidity in fact is 2 parts per million.

Launder.—Around the circumference of the clarifying tank is a trough or

launder 4 ft. deep and 3 ft. wide. Its inner wall being a few inches below the level of the top edger of the tank, the water overflows into the trough and is carried around in both directions to a point opposite the settling tank, which tank is equipped with a trough or launder similar to the one in the clarifying tank. Having gotten rid of the floc in the first tank, rough treatment of the effluent is immaterial, and for that reason, the settling tank is 1 ft. lower than the clarifying tank. From the launder of the clarifying tank, the water is carried through an offtake to the feed-well of the settling tank. From here, as in the clarifying tank, the water spreads across the bottom with no observable velocity, rises and overflows into a trough or launder and discharges into the carbonating tank, through a dip pipe extending to within 4 ft. of the bottom. From this point, the water rises and passes out through an overflow to the soft water basin.

Carbonation.—It was decided to try carbonating in the feed-well of the settling tank, expecting, by this method, to give the fine suspended calcium carbonate ample time to settle. The results were very gratifying in that we found we could not only reach lower alkalinities but could easily control the turbidity by adding 2/10 grains per gallon of sulphate of alumina.

The effluent from our settling basin now averages ½ part per million turbidity where it previously ran as high as 10 to 15 parts per million.

By careful operation of our carbonating system, we are able to reduce the total alkalinity from an average of 55 to about 35 in the settling tank.

Additional carbonating in the original carbonating tank brings the alkalinity down to an average of 30 parts per million and by the exercise of the greatest care we can reach 23 to 25 parts per million.

Analysis of Water.—An analysis of the water at the various points throughout the system on a representative day, shows the following:

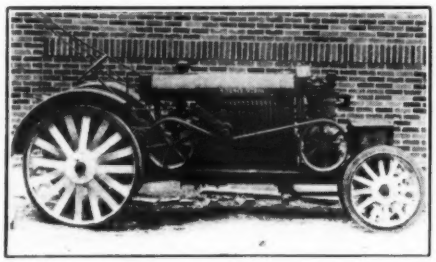
Raw Water	Carbonates	300
	Non-carbonates	400
	Total	700
Mixing Tank Effluent	Total alkalinity	55
	Phenol. alk.	40
	Caustic	25
	Non-carbonates	150
	Total	205
Clarifier	Total alkalinity	55
	Phenol. alk.	16
	Caustic	25
	Non-carbonates	150
	Total	205
Settling Tank (After first carbonation)	Total alkalinity	35
	Phenol. alk.	16
	Caustic	0
	Non-carbonates	150
	Total	185
Carbonation Tank (After second carbonation)	Total alkalinity	30
	Phenol. alk.	4
	Caustic	0
	Non-carbonates	150
	Total	180

Chemical Handling.—An interesting part of the layout is the method of unloading the lime and soda ash, received in bulk carload lots, from which it is elevated by an "Airveyor," which is a vacuum method of elevating the material into the storage tanks by means of vacuum of from 6 in. to 9 in., the air and material being separated in a filter located on the top of the storage tanks.

New Self-Propelling Air Compressor

A self-propelling 4-wheel air compressor, capable of handling heavy loads behind itself and move about on the job under its own power, has been brought out by the Pontiac Tractor Co., Pontiac, Mich.

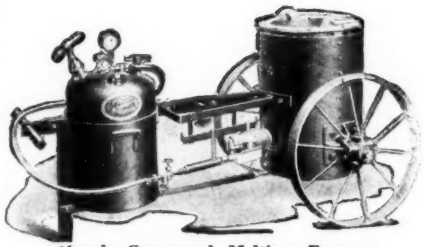
The compressor is a Quincy Type W-4 of 124 cu. ft. displacement, having a separate radiator with pump driven circulation. This holds the temperature of the air coming from the compressor 60 to 70° below the temperature of compressors which are cooled from the motive-power radiator. The compressor has a 3-bearing crankshaft and force feed lubrication. This unit is controlled by a Penn unloader with hand unloader attachment. The compressor with air tank and tool box are mounted on a frame which attaches to either the McCormick-Deering or Fordson Tractors. Power is taken from the tractor to drive the compressor through the power take-off pulley, which has a clutch allowing it to be thrown out or into gear at will. The "ahead" drive of the belt brings the belt tightener into the correct relation with the belt.



New Air Compressor Outfit

New Compound Melting Furnace

To keep sewer joint and lead compounds hot, and therefore easily appliable for tight joints, a kerosene compound melting furnace on wheels, has been added to the line of oil burning lead and compound melting furnaces of the Hauck Manufacturing Co., Brooklyn, N. Y. This furnace has been especially designed for melting "G-K Sewer Joint Compound"—"Lead-Hydrotite"—"Leadite" and other compounds. A cast iron pot is furnished as steel pots cause excessive carbonization of material; it is of 120 lb. compound capacity or about eight gallons liquid. It takes but five minutes to put furnace in operation. The burner is stated to consume about 1 gal. of kerosene per hour; it's on a "slide-rail" so that the heat under the pot can be fully controlled by putting it close up to the furnace for full heat, or move it away for less heat under the pot. The 12 gal. tank is of pressed steel construction (not a welded tank) so that furnace can be operated for 12 hours steadily with one filling. Furnace is constructed of heavy sheet steel; 24 in. roller bearing wheels 2½ in. face.



Hauck Compound Melting Furnace

Cites Benefits of Public Health Surveys

Dr. M. P. Horwood, assistant professor of biology and public health at the Massachusetts Institute of Technology, told those attending the Second Public Health Institute at the Massachusetts Institute of Technology, Boston, recently, of the benefits of public health surveys.

Among the things a public health survey does, he said, is to present a clear picture of the health situation, how to spend money for health work more wisely, serves educational purposes and brings about the addition of needed assistance.

Speaking on city health appraisal forms, Dr. F. H. Walker, of the American Child Health Association, New York, brought out that a recent study made of 186 cities showed that only six of those examined did not have a good water supply. Two weeks in a camp for children during the summer for the treatment of tuberculosis is not enough, he said, pointing out that the effect is not lasting. At least six weeks are needed, he said.

Major Highway Plan for Lucas County, O.—The report of Harlan Bartholomew and Associates for the Lucas County (O.) Planning Commission proposes three types of highways for the county:

(1) Superhighways—width of right-of way, 170 ft.

(2) Primary highways — width of right-of-way, 140 ft.

(3) Major county roads—width of right-of-way, 80-120 ft.

Device for Determining Turbidities in Water

Low Reading Turbidimeter Used at St. Louis, Mo.

An interesting arrangement for the determination of turbidities is employed at the Chain of Rocks filter plant of St. Louis, Mo.

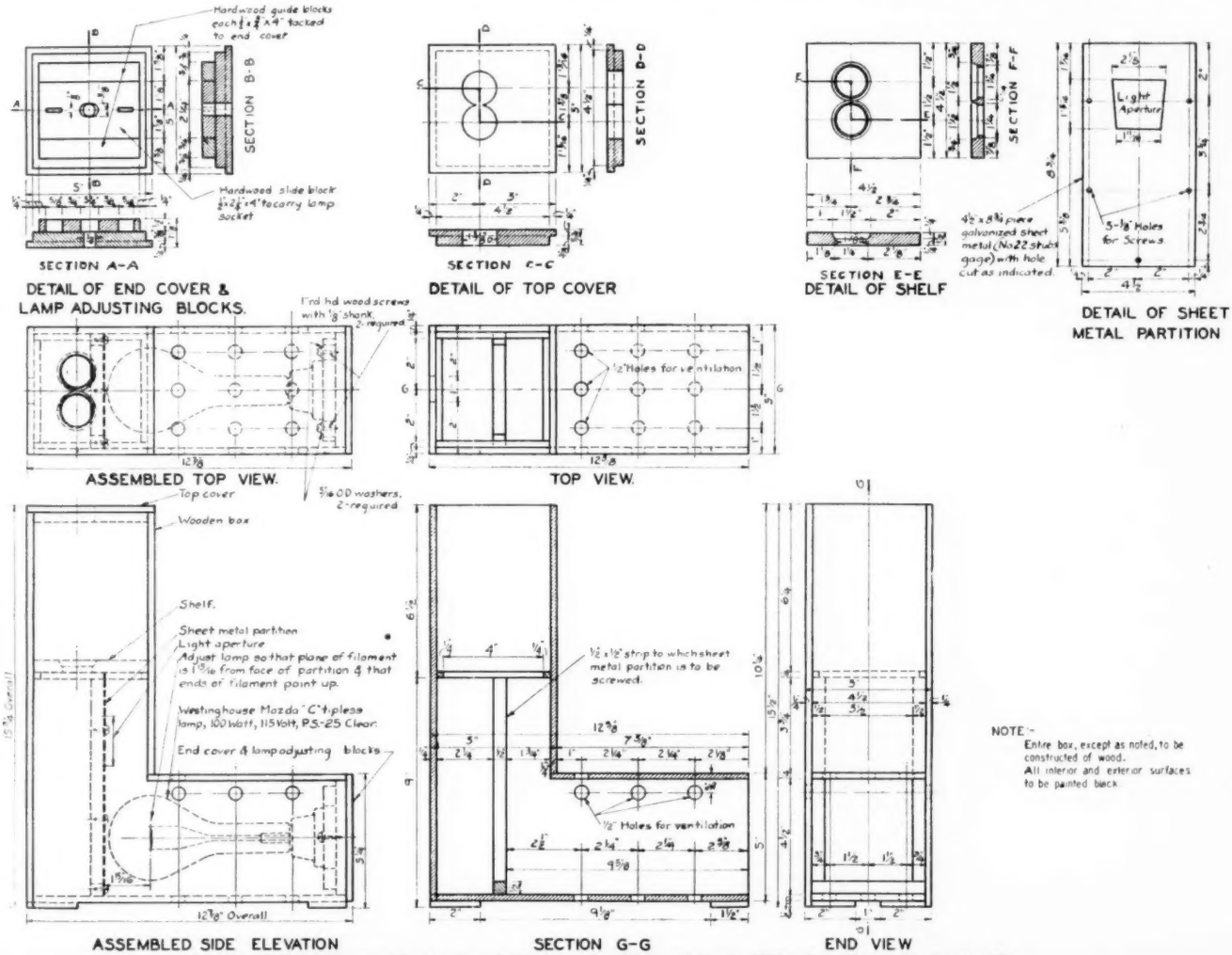
Description of Box.—The entire box, except the partition is constructed of wood and is painted black, both inside and outside. The partition is of galvanized sheet metal, also painted black. All inside dimensions of the box and parts should be made exactly as indicated because the dimensions locating the normal position of the light filament the light aperture in the partition and the circular openings in the shelf are important.

The position of the light aperture in the partition and the openings in the shelf are fixed but the position of the light filament is adjustable. This was made so in order to take care of slight variations in the shape and position of the filament in the lamp. The filament may be moved closer to or farther away from the partition by adjusting the metal contact in the light socket. The filament may be shifted from side to side by means of the sliding block which carries the lamp socket. The position of the filament from top to bottom is fixed: the open end of the filament should point up. The position of the filament need be fixed only once for each lamp.

Ventilation is provided by means of the circular openings in the box but the lamp should be lighted only when the box is in use.

Preparation of Standards.—The glass tubes to be used for making the turbidity determinations should be clear glass 100 cubic centimeter, short form Nessler tubes free from scratches or other imperfections. These tubes should be scrupulously clean at all times. Fresh standards should be prepared each day from a stock suspension, the turbidity of which should be 10 parts per million, so that when one cubic centimeter of the suspension is made up to 100 cubic centimeters with turbidity free distilled water a standard containing 0.1 part per million will be obtained. The suspension containing 10 parts per million can be made from a suspension containing enough turbidity to be determined by the Jackson candle turbidimeter and diluted to yield the desired standard stock suspension. The standards to prepare will depend upon the turbidity of the water being tested. Experience will soon enable the observer to reduce the number of standards required to a minimum.

Introduce 100 cubic centimeters of the sample in one of the tubes and set it into one of the holes in the shelf. After all air bubbles have risen to the surface, the sample is ready for comparison with the standards. If the sample is a filtered water of low turbidity, the standard of 0.5 part per million may be prepared and set in the other hole in the shelf and after all air bubbles have disappeared, the comparison may be


Hardwood guide blocks each ⅞ x ⅞ x 4" tacked to end cover
SECTION B-B
Hardwood slide block ⅞ x 2½ x 4" to carry lamp socket
SECTION A-A
DETAIL OF END COVER & LAMP ADJUSTING BLOCKS.
SECTION D-D
SECTION C-C
DETAIL OF TOP COVER
SECTION F-F
SECTION E-E
DETAIL OF SHELF
Light Aperture
5-⅛" Holes for Screws
4½ x 8¾ piece galvanized sheet metal (No 22 sheet gage) with hole cut as indicated.
DETAIL OF SHEET METAL PARTITION
ASSEMBLED TOP VIEW.
½" Holes for ventilation
TOP VIEW.
Top cover
Wooden box
Shelf.
Sheet metal partition
Light aperture
Adjust lamp so that plane of filament is 1⅜ from face of partition & that ends of filament point up.
Westinghouse Mazda "C" tipless lamp, 100 Watt, 115 Volt, PS-25 Clear.
End cover & lamp adjusting blocks
½ x ½" strip to which sheet metal partition is to be screwed.
½" Holes for ventilation
ASSEMBLED SIDE ELEVATION
SECTION G-G
END VIEW
NOTE:- Entire box, except as noted, to be constructed of wood. All interior and exterior surfaces to be painted black.

Details of Turbidimeter Designed and Used at the Chain of Rocks Filtration Plant, St. Louis, Mo.

made. If the turbidity of the sample is less than 0.5, estimate and prepare a weaker standard. If greater, prepare a standard of higher turbidity.

The principle involved in the determination of turbidities in this box is the observation, against a dark background, of the suspended particles in the sample of liquid illuminated by admitting light rays at an angle, through the bottom of a glass tube which is contained in a dark chamber.

Turbidities ranging from 0 to 15 parts per million may be determined.

This box was designed by the laboratory staff of the Chain of Rocks Plant and was built by the department's carpenters.

Inspection and Maintenance of Filter Beds

By J. M. JESTER
Engineering Assistant, Washington Suburban Sanitary District, Hyattsville, Md.

In order to obtain the best and most satisfactory results from the filters at the several water filtration plants in the Washington Suburban Sanitary District it is necessary to inspect the filter beds at regular and frequent intervals. The expense attached to these inspections is slight as compared to the possible loss of a filter or two due to improper functioning at a time when most needed.

Satisfactory effluents may be obtained from filters having several blown strainers if the raw water turbidity is low at this time, but with high turbidities good effluents are difficult or perhaps impossible to secure. The effluents may be in such a condition as to make it necessary to place these filters out of service, and if the plant is operating at full or nearly full capacity, the remaining filters will have to be overloaded at a time when they should be run at rates as low as possible. The overloading of these remaining filters may mean still further trouble in obtaining satisfactory effluents as long as the high turbidities prevail. It is more than likely the trouble experienced could have been avoided if regular and frequent inspections had been made.

Procedure in Inspecting Filters.—In inspecting filter beds I find the following procedure gives good results. The filter is first washed in the usual way. The influent valve is shut off and the filter bed drained. The sand depth is checked to ascertain whether or not sand is being lost from the bed. A loss of sand would indicate too high a rate of wash water or trouble in the underdrains. The surface of the bed is next examined for mud balls, mud cracks, or funnel-shaped craters. The presence of mud balls indicates improper washing probably caused by a low rate or too short a period of washing. Mud cracks, if found, indicate clogged underdrains. This should be given immediate attention because of overloading of the remainder of the bed to obtain normal rates. Craters also indicate trouble with the underdrains, probably a blown strainer or two. A filter found to have blown strainers should be put out of service immediately and be kept out until proper repairs can be made, in order to prevent loss of sand from the bed, the passage of improperly filtered water, or both. To replace a blown strainer, only a section of 5 or 6 ft. of the bed surrounding the crater need be removed. Where high pressure wash water is used strainers may be blown by opening the wash water valve too quickly. If the strainers continue to blow in various sections of the filter with normal washings, it is advisable to give the underdrain system a complete overhauling as the laterals probably are in bad condition.

The filters at our plants are equipped with sight bottles attached to each of the effluent lines. These bottles are located on the operating floor beside the filter. They show, at a glance, the condition of each effluent. Should a strainer be blown or lateral bursted during the washing of the bed, sand will begin to collect in the sight bottles immediately after the filter is placed back into operation. In this way we have been able to detect blown strainers and take the filter out of operation before much sand has been lost from the bed.

Examination of Sand.—The sand is examined for mud after the surface of the filter has been inspected. This is done by rubbing between the hands a small amount of sand taken from various points on the bed. If mud appears on the hands from each point examined it indicates that too low a rate of wash is being used. Should the mud appear only at several points it would indicate clogged underdrains. Clogged underdrains must be given attention as soon as possible. I have found that a larger and larger area becomes dead if a filter having clogged underdrains is left in operation. This results in a rapid loss in the rate of filtration and more frequent washing. The remainder of the filter, being relatively clean, is overloaded in an endeavor to maintain the desired output. Clogged filter sand may be located, also, by thrusting a hoe down into the bed during washing. It is difficult to get the hoe down in the clogged areas as the sand does not come up in suspension.

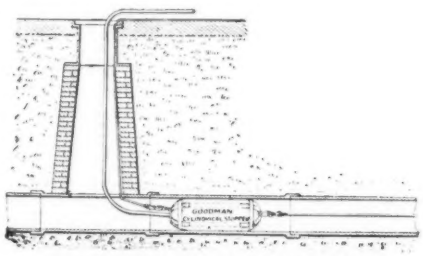
The next step is to take a hoe or shovel and dig into the sand at several points on the bed to determine whether or not there is any gravel in the sand. Should gravel be found in the sand, either the wash-water rate is too high and should be decreased, or the gravel at the bottom of the bed is of insufficient size to spread the wash-water properly.

The holes dug in the bed are finally filled and the surface of the sand leveled off with a rake. The filter is now washed, the surface being watched closely to note whether or not the appearance of the wash-water is uniform over the entire surface of the bed. The wash-water rate is checked by measuring the vertical rise of the water, and a beaker full of the water is caught and examined for sand. After completing the washing process the filter is ready to be placed into service again, if found in proper condition.

Acknowledgment.—The above article is taken from the Proceedings of the (1928) Second Annual Conference of the Maryland Water and Sewerage Association.

Handy Device in Stopping Flow in Sewers

A useful device for stopping the flow in a sewer while repairs on other work is under way is an inflatable bag with a rugged water proofed casing. This is folded and run down into the sewer and then inflated, thus shutting off the flow at the point of flow. It is stated that thus not only does the broad contact surface insure against the stopper slipping in the pipe, say the manufacturers, but stiffeners inserted in the bag insure straightening out in the sewer as inflation progresses.



Stopping Flow in Sewer with Goodman Cylindrical Stopper

This device, which is made by the Safety Gas Main Stopper Co., 523 Atlantic Ave., Brooklyn, N. Y., also is used in repairing and altering water mains and setting hydrants. When so used this stopper is said to be sufficient to resist pressure under the head required to supply a second story. It provides a dry main so that the men may do their work under the best conditions without resorting to pumping. When necessary, an extra length of tubing can be attached to the stopper.

Cities Regulate Radio Interference.—Several cities have taken the initiative and have passed radio interference ordinances. Zanesville, O., took this step nearly three years ago. Other cities which have such legislation are Oshkosh and North Fond Du Lac, Wis.; Norton and Russell, Kan.; Portland, Ore.; Bay City, Mich.; Fairfield, Ia. The Denver, Colo., council discussed the matter a few months ago, but no ordinance was passed.

The Activated Sludge Plant at Grand Canyon National Park, Arizona

Effluent Used for Industrial Purposes

By JANE H. RIDER
Sanitary Engineer, University of Arizona, Tucson, Ariz.

THE sewage treatment plant at Grand Canyon, Arizona, has an unusual duty to perform. It must not only dispose of the sewage in such a manner that the resulting effluent will not be a menace to the health of the community, but the purification must be sufficient to permit this effluent to be used for industrial purposes.

No water supply is available on the south rim of the canyon. All the water used is hauled for 100 miles from Flagstaff or 122 miles from Puro in 10,000-gal. tank cars, making the cost $3.09 per 1,000 gal. delivered at Grand Canyon. Water must be provided for a permanent population of 400, and the 134,053 tourists who visit the Park each year. Two hotels, a tourist camp, a stable with 150 mules, a 1,282 h. p. steam power plant, a laundry and an ice plant, are maintained to care for these tourists. Lawns and gardens must be irrigated, and water furnished for the boilers of the many locomotives used on the Grand Canyon branch of the Santa Fe Ry. The present water consumption is from 50,000 to 110,000 gal. of clear water per day, and approximately 72,700 gal. of reclaimed sewage.

The Old Septic Tank.—In 1913, in an effort to conserve this expensive water, it was decided to filter the effluent from the old plant and use this reclaimed sewage for the boilers and irrigation. The old plant, consisted of a 3-compartment septic tank, with two 4-compartment filters filled with crushed rock, and a specially designed sand filter which was constructed in the railway shops at San Bernardino. The effluent from this plant was satisfactory for industrial purposes until the number of visitors to Grand Canyon began to increase rapidly, when the old plant became so overloaded that it was necessary at times to by-pass the sewage. The odor from the septic tanks became very offensive, the effluent caused foaming in the boilers, and in 1925 it became necessary to construct a larger plant.

The New Activated Sludge Plant.—Considering all local conditions and the degree of purification required, it was decided that an activated sludge plant would be the most effective installation. The sewerage system and plant were designed by H. B. Hommon, Sanitary Engineer in Charge, U. S. P. H. S., and M. R. Tillotson, then Park Engineer, and constructed jointly by the National Park Service and the Santa Fe Railway. The National Park Service paid $71,992 of the total cost and the Santa Fe approximately $25,000. A definite quantity of reclaimed sewage is allotted to the government and railroad for their respective uses.

The plant consists of bar screens, a presettling tank, diversion box and mixing channel, two aeration tanks, a slow settling tank, with mechanical clarifier, two rapid sand filters, a clear well, chlorinator, and pumps for the return sludge and reclaimed sewage.

The estimates for the volume of sewage were obtained by examining the freight records of the Santa Fe Railway for a period of years to find the number of cars of water which had been hauled to Grand Canyon. Graphs were made representing the actual water consumption and consequent estimated sewage flow. These were extended to 1940. The plant was designed for a capacity of 200,000 gal. per day with a 6-hour aeration period or 300,000 gal. with a 4-hour period. At present they are treating an average of 76,250 gal. per day.

The Sewer System.—The sewer system has a 10 in. vitrified, salt glazed clay pipe for the volt-fall line. A 6 in. vitrified pipe laid in the same trench was provided for the laundry waste water. The concrete manholes were constructed with double compartments, the sewage flowing through one side and the laundry waste the other. The laundry waste line bypasses the plant, as it was thought that the soap, soda and other chemicals used in the laundry could not be treated by the activated sludge process sufficiently to make it suitable for use in the boilers. The waste line below the plant is 8 in. vitrified clay pipe, both laundry waste and excess sludge flow through this line, which empties on the ground at the head of a ravine about 3.5 miles southwest of the plant. The piping is arranged so that in case of emergency the raw sewage will by-pass the plant and flow through the waste line directly to the disposal ground.

Details of the Plant.—There is a double compartment coarse bar screen chamber 30 in. long, 36 in. wide and 36 in. deep with 2x⅜ in. wrought iron bars spaced 2⅜ in. O. C. at a 30° angle. This is connected by 204 ft. of 10 in. vitrified clay pipe with the pre-settling tank, which has a double hopper bottom. This tank is 16 ft. long and 8 ft. wide, with a vertical depth of 5 ft. and a total depth of 9 ft. to the bottom of the hoppers. The drains from the hoppers discharge directly into the waste line. There are two outlets for the sewage; one at the same level as the effluent line, the other 5 in. lower. This tank with a capacity of 6,064 gals. can also be used as a storage basin during temporary shutdowns of the plant.

The liquid from the presettling tank flows through 52 ft. 8 in. of 10 in. vitrified clay pipe to a concrete diversion box 30x30x18 in. where it is mixed with the returned activated sludge. An arrangement of shear gates in the diversion box allows the sewage to be by-passed around the plant to the waste line.

Novel Feature of Aeration Tanks.—The two aeration tanks are each 42 ft. long, 8 ft. wide and have an effective depth of 11 ft. The capacity of each tank is 23,517 gal. They are arranged so that they may be used independently of each other or in series. The ridge and furrow system of aeration is used, the bottom of the tanks having a row of 37 Filtros plates on each side of a center cross ridge. The novel feature of the design is the arrangement for the compressed air. An air channel 11 in. wide and 7 in deep runs the entire length of the tanks under each row of filtros plates, which are 12 in. square by 1½ in. thick. The holders for the plates were made by increasing the width of the upper 1½ in. of the air channel to 13 ins. and placing 2½x1¼ in. x 2.87 lbs. T-irons across the channel, the ends resting on the concrete ledge. When the filtros plates were in place the ½ in. space on each edge was filled with a cement grout. The air is water-washed and no air filters are used. An aeration period of 5½ to 6 hours is producing a satisfactory sludge.

The Slow Settling Tank.—The activated sludge and aerated liquor flow through a trough, which has submerged parts, into the slow settling tank. This tank is 16 ft. square by 13 ft. deep with a capacity of 22,547 gal. the bottom sloping slightly towards the center. It is equipped with a Dorr clarifier, which makes one revolution every 4½ minutes, the scraping blades on the arms moving the thickened sludge to the hopper bottom at the center. A cast iron pipe connects the hopper bottom with the pump which returns

the activated sludge to the diversion box. When sludge accumulates, in excess of that necessary to maintain the 20 per cent sludge content of the tanks, it is drawn off by gravity into the waste line.

A pump with a capacity of 90 gal. per minute was originally used to pump the sludge. This pump failed in July, 1927, probably due to the impossibility of keeping ordinary grease in the bottom bushings. This caused the shaft and the augurs for lifting the sludge to wear rapidly. This pump has been replaced with an air lift pump, which utilizes the excess amount of air produced by the compressors.

Coagulating Chamber.—The clarified liquor from the slow settling tank flows over a 12 in. submerged weir into a trough with a Stein weir and then into a coagulating chamber 16 ft. long 5 ft. wide and 13 ft. deep. It was originally intended to treat the liquor with alum at this point and an alum solution tank and an automatic feeding device were installed. It was found, however, that alum made the reclaimed sewage too acid for the boilers. Since they have stopped using alum, laboratory tests have shown that the alkalinity of the sewage was reduced from 200 p. p. m. to approximately 25 p. p. m. in passing through the plant. A satisfactory organic mat is now formed on the filters without the use of coagulants and the filters will operate properly if there is less than 15 p. p. m. suspended matter in the effluent from the slow settling tank.

Sand Filters.—The two sand filters are 10 ft. long, 16 ft. wide and 6 ft. deep. There is 52 in. of filtering medium arranged as follows: 8 in. passing through 2½ in. mesh and retained on a 1½ in. mesh. 4 in. passing through a 1½ in. mesh and retained on a ¾ in. mesh. 4 in. passing through a ¾ in. mesh and retained on a ¼ in. mesh. 4 in. passing through a ¼ in. mesh and retained on a 1/12 in. mesh. On top of this gravel is a 32 in. layer of sand with an effective size of 0.40 to 0.45 in. and a uniformity coefficient of approximately 1.6. Large cast iron underdrains were specially designed to collect the filtered water and carry it through the Venturi meters, connected with the rate of flow gages to the clear well.

Water for washing the filters is stored in a 12,000 gal. corrugated metal tank located on the hill above the plant giving a 30 ft. head. The wash water flows through an 8 in. cast iron pipe and is forced through the cast iron underdrains and the filtering material. The dirty wash water is carried off through a trough to a 15,000 gal. settling basin. From this basin it is pumped into the presettling tank so that it may again be purified and no water wasted. Six to eight thousand gallons of water are used for cleaning the filters, the average time between washings is 52.6 hours.

Chlorination of Effluent.—The clear well is 9 ft. long, 16 ft. wide and 5 ft. 6 in. deep. The treated effluent is sterilized in the clear well with liquid chlorine applied near the pump suction with a Wallace and Tiernan S. A. V. A. semi-automatically controlled vacuum feed machine. The average dosage is 3.6 p. p. m. Ortho-tolidine tests are made to regulate the excess chlorine which is kept at 0.5 p. p. m. The suspended matter, which varies from 138 to 389 p. p. m. in the raw sewage, is reduced to about 3.0 p. p. m. in the clear well, the ammonia nitrogen, is reduced 97 to 99 per cent, the dissolved oxygen averages from 3.1 to 6.0 p. p. m. while the B. O. D. varies from 0.5 to 2.5 p. p. m.

Pipe System for Effluent.—Three-stage centrifugal pumps, size 2, made by the American Well Works Company, operating under a maximum head of 125 ft. deliver the reclaimed sewage to a 250,000 gal. covered metal storage tank located at a high point in the village. Standard class B cast iron pipes are used for the gravity mains and branches. These pipes are encased in vitrified tile and where exposed are painted red. An accurate print has been made of the entire system of piping for the reclaimed sewage, so the lines may be easily identified in the future, and to eliminate any possibility of their being cross connected with the clear water lines.

Uses of Effluent.—It has been found that the reclaimed sewage is softer than the clear water and more satisfactory for boiler use. In order to further conserve water, the laundry waste is now being added to the raw sewage and satisfactorily treated at the plant. The plant now furnishes approximately 1,281,750 gals. of reclaimed sewage a month to the Santa Fe Railway. This is used to cool the Diesel engines, for the cooling tower of the ice plant, locomotive boilers, irrigating the lawns, and fire protection. At present there is an excess above the demand, so the railroad is planning to use this water for flushing the toilets at the passenger station and Bright Angel Camp and possibly for washing automobiles. The government uses it for flushing the toilets at the public camp ground and for the sprinkling of the recreation field.

The plant is in charge of D. Travaini, a graduate sanitary engineer, and it is largely due to his great interest and technical skill that the plant has operated so successfully. Construction and operating data for this paper were furnished by M. R. Tillotson, Superintendent of Grand Canyon National Park, D. Travaini, and E. Nelson, Chief Engineer for the Santa Fe Ry. at Grand Canyon.

Acknowledgment.—The foregoing is a paper prepared for the 10th Texas Water Works Short School.

Family Allowance Fund in Belgium

Under the terms of a recently enacted law in Belgium, according to the New York Times, all contracts relative to works executed or subsidized by the State, provinces or communes must include a clause making it obligatory upon contractors to become members of a compensation fund for family allowances.

Industrial establishments from whom the State, provinces and communes order supplies are also obliged to be members of a compensation fund, provided supplies are furnished to the amount of at least 50,000 francs. The same is likewise imposed upon subcontractors. Public service enterprises conducted under concessions come under the provisions of this act, and the King may extend its provisions to public establishments and to institutions of public utility.

In order to meet the requirements of the law, compensation funds for family allowances should assure, for each child under 14 years of age, payment of a monthly allowance of at least 15 francs for the first child, 20 francs for the second child, 40 francs for the third child and 80 francs for each subsequent child. The King has authority, however, to allow compensation funds to adopt another scale, provided the resulting cost is not below that involved in the fixed scale given above.

In no case is a compensation fund obliged to distribute in a family allowances more than 3 per cent in excess of the total wages and salaries paid by all the establishments affiliated with such fund.

Family allowances must be paid to both wage earners and salaried employes, and will be proportioned to the number of days actually worked by the wage earner or employe in the month. In all cases such allowances accrue from the first day worked. Consideration will be given to interruptions due to sickness, accident, unemployment, and for all other legitimate causes.

Allowances will be paid to employes and workers, without distinction of sex, for their own children, stepchildren and children whom they are actually taking care of because of abandonment or because of the death or illness of such children's fathers or mothers. Account is also to be taken of recognized illegitimate children. Under certain circumstances allowances are paid for children up to 18 years of age. The act is to go into effect in October.

Some Unusual Conditions Discovered Through Pitometer Water Waste Surveys

Paper Read Before Central States Section
of American Water Works Association

By H. E. BECKWITH
District Manager, The Pitometer Co.

IT IS NOT the purpose of this paper to deal with the technical aspect of the work being done by our company, but it is merely the recital, in an informal manner, of several conditions encountered in our work which are of interest principally because they are unusual.

In calling attention to those conditions which we have encountered in our work, I am desiring to return in small measure the helpful courtesies shown us by the men in the water works field, and with the hope that you may find some helpful hint in the conditions we have found to exist on other plants.

Closed Valves.—It is, of course, very common for us to find closed valves. Your attention is called to two such instances: In the first of these an entire town of some twenty thousand persons was being fed through four six-inch mains, because a valve on the main sixteen inch feed was closed. Moreover, this was the only valve in the entire system found closed, showing that care was taken to check up on the valves. Furthermore, and this is of special importance, it was the only geared valve in the system. When the operating nut on the gear was turned in a clockwise direction, the valve stem was turned counter-clockwise. As the valve stem on this valve closed in the same direction as all other valve stems in the system, it was necessary to turn the operating nut in the direction opposite to that of every other operating nut in order to close the valve. Someone failed to take this into consideration, with the result that the valve had been kept habitually closed.

Hydraulic Grade Line.—In the second case, the hydraulic grade line was apparently lower at one point than it was at another point on the same line, three-quarters of a mile further from the source of supply. This was on the system of a small company serving several miles of territory with laterals feeding directly off one long main—or rather—it had been one long main originally. For a mile and a half of its length it had later been paralleled with another main. This second main was tied to the orginal main at no place other than at its ends, and no laterals came off of it. A study was being made for the purpose of reinforcing the system. When the hydraulic gradient for the system, as determined in the field, was plotted on cross-section paper, it was found that mid-way between the ends of the two parallel mains the hydraulic grade line was lower than at either end. Subsequently, the valve on the reservoir end of the "old" main was found to be closed. All water being used along the mile and a half of parallel mains had to go to the father end and then feed back toward the reservoir. Opening the closed valve, of course, took the sag out of the grade line and increased pressure below the point where the valve had been closed. The trouble in this case was caused by right and left-hand valves being indiscriminately sprinkled throughout the system.

Reservoir Cases.—Speaking of hydraulic gradients: There is the case of the city whose officials had believed their system was being fed by two mains from the reservoir. A Pitometer test proved, however, that there was no flow through one of these pipes. Further investigation showed that this main at one point actually lay above the water-level of the reservoir.

Another very interesting case was that of a city which had originally been served by two separate companies. Later, these companies were merged and the distribution system inter-connected. Each of these companies originally secured its water by gravity from a mountain reservoir, the reservoir of one company being twelve feet higher than that of the other company. Since the complete metering of this system a few years ago the meters through which water was sold had accounted for a little less than fifty per cent of the water shown on the Venturi meters installed at the reservoirs. Our tests showed that during the night, when the use of water in the system dropped low, the water fed out of the higher reservoir into the lower. The water which fed from the higher to the lower reservoir was measured on each of the two Venturi meters, although as a matter of fact, it was never used in the distribution system at all.

Whenever a water system is fed by gravity from two or more reservoirs on different levels, it is well to grow immediately suspicious of back-feeding when the supply in the lower reservoir holds up better than the supply in the upper ones.

Incorrect Meter Reading.—Another very interesting case was that of a small suburban city which purchased water from its larger neighbor by meter. As the city was being paid on its meters for less than half the water entering the distribution system, the water department had accumulated a large deficit. In addition to the conditions usually found by a survey, it was discovered that two four-inch meters and two six-inch meters were being incorrectly read, and that the city was being paid for only ten per cent of the water going through them. The value of the water which had passed through the meters, but which had never been paid for, was nearly equal to the deficit of the department. An effort was made to collect this money on the grounds that the bills rendered the consumer bore the meter-readings and his acceptance and payment of the bills constituted an acceptance of the correctness of the meter-readings. As the department did not use a step rate, the matter of billing was comparatively simple.

This under-reading was caused by the fact that the smallest dial on the meters involved was graduated in units of one hundred, whereas the smallest dial on all other meters on the system was graduated in units of ten.

That this is not the only case of its kind is shown by the fact that another similar condition was recently found. As a remedy for this it is suggested that meter-readers be not permitted to take their previous readings on a meter into the field and so help to carry the error through, and it is further suggested that the office clerks be forbidden to change any readings in order to make them conform to previous readings. Wherever a doubt exists as to the accuracy of the reading on a large meter it would be well to have it checked by the meter company's representative.

Meter Out of Water.—Another suburban city, which also purchased its water through a meter, presented this problem: Periodically, the receipts from the water department would drop below the cost of its water. The trouble in this case lay in a compound meter to a steel mill. The high duty side of this meter was dead; and whenever business was sufficiently good with the steel company to cause a draught of water large enough to throw the flow onto the high duty side of the meter, business was very bad with the water department.

Unrecorded Services.—In another suburban borough which purchased water by meter, the newspapers stated that the leak discovered by the survey had been running for twenty-five years and had cost the borough in that time a quarter of a million dollars. This is not of particular interest here, except as it lends point to another statement made by the same news article. It seems that, when a large sewer was laid past this leak, it was impossible to handle the water with a pump. It was decided that a spring had been tapped and special foundations were put in to protect the sewer. It should be noted here that the leak was from the open end of an abandoned service of which the borough had no record.

Unauthorized Use.—Several years ago, when the stock of privately owned water companies was more or less a drug on the market, and few companies had paid dividends in many, many years, we caused considerable consternation on the part of the president of one company where we were working. It developed that a certain manufacturing company in the city was getting about one hundred thousand gallons of water a day free, through a defective meter. The president of the water company was also president of this factory. It was bad enough, he felt, not to get any dividends on his water company stock, without having the dividends of his factory cut into by increased water bills.

As a matter of fact, we find it generally true that, where water is being taken in an unauthorized manner, it is done without the knowledge or consent of the higher officials of the companies. It is usually some department head who wants to take a short cut to a good showing for his department.

Efficiency of Pumps.—In recent years there has been a rapid increase in the development of electric power, with the result that many water plants have found it economical to substitute electrically driven centrifugal pumps for the old steam plant. Unfortunately, a full realization of the limitations of this type of pumping unit does not seem to have accompanied its installation. In only too many cases the only requirement placed on the pump is that it pump water. No apparent consideration is given to the efficiency with which this work is done. The displacement type of pump allowed so much latitude in operating conditions that many plant operations have not yet come to a full realization that centrifugal pumps operate efficiently only under the design head, and at the design rate of discharge.

No branch of work being done by our firm is more interesting than the efficiency tests on electrically driven centrifugal pumps. In one instance the pumping units were 2 two and a half million gallon pumps, working in parallel to give a combined output of five million gallons per day. These pumps were designed to work against a head of one hundred pounds. The time came when these pumps would not carry the maximum day load. So the output was increased by putting the discharge of these two pumps through a five million gallon pump designed to pump against a head of fifty pounds. This gave, then, an installation designed to pump five million gallons against a head of one hundred and fifty pounds, whereas it was working against a head of only one hundred pounds. This gave an increased rate of discharge but at a considerable cost in efficiency. This was not the sole reason why the wire to water efficiency of the installation was under forty-four per cent, as several pieces of wood were later taken from the ports of one of the pumps, but it did have a very important bearing on the loss of efficiency. It is of interest to add that, after disconnecting the fifty-pound pump from the discharge of the two and a half million gallon pumps, and cleaning these latter out thoroughly, a subsequent test on these two pumps gave an over-all wire to water efficiency in excess of seventy per cent.

Slippage in Pump.—In another instance the clear well was of such small size that it was necessary to coordinate the flow from the filters into the clear well with the pumpage out of it. As the low lift pump from the river to the filters had a higher rate of discharge than had the pump from the clear well to the distribution system, this coordination between the two pumps was secured by partially closing a valve on the discharge of the low lift pump. This increased the head at the pump above its design head and induced a slip into it. So much was this increase in head and slip, that the power required to pump the reduced flow was much more than would have been required to pump the greater quantity for which it had been designed, had it been operating under design conditions. Throttled down, the pump had an over-all efficiency of approximately thirty per cent. A new low lift installation designed for a discharge equal to that of the high lift pump, thereby eliminating the necessity for throttling, gave, on test, an over-all efficiency of approximately sixty per cent.

Queer Design.—Then, there was the centrifugal pump whose ten-inch discharge line was reduced to six inches for a few lengths of pipe. The explanation given for this novel procedure was that the water pressure would be increased after going through the smaller pipe. This reasoning sounds strange to us today, but one of our engineers, delving through the council records of a city where he was working, found a case equally interesting.

Some sixty years ago when our knowledge of hydraulics was not as extensive as it is today, an engineer had been employed to design a main between the reservoir and the city. This main was partly twenty-inch and partly eighteen-inch, fed by a twelve-inch from the reservoir. The engineer in charge of the work made the following statement:

"This main line of pipe was enlarged by the direction of the Committee on Water under the light head at the Westerly end, to render the same much more effective as a means of conveying and delivering water at the extreme end of the pipe here in the city. Since the lighter the head, the larger is the required diameter of the pipes necessary to furnish the amount of water conveyed by the small pipe under a much greater increase of head; this change has been one of much utility in increasing the efficiency of this supply main."

Did Not Work.—Within ten years after the main was put in service, the supply in the city became so deficient that the main was not full at all times. The report of the Water Committee says, "While the discussion was going on about the High Service, the Engineer discovered that the main pipe already laid was wrong end first, and that the advantages of having a small pipe near the reservoir to fill and supply a larger one in the city, were not so great as he at first supposed."

These are only a small part of the interesting conditions found by our company in the thirty years it has been doing its special work. Almost every plant has its own particular problem, and it is not always possible to tell in advance just what that problem is.

Zoning System for Water Bills, Adopted at Toledo, O.

The Commissioner of Water of Toledo, O., has adopted the zoning system for reading meters and paying water bills. The whole city has been divided into six zones of approximately equal size. Meters in each zone will be read twice a year, but the readings and bills due are rotated so that the city will receive payments from one zone each month. This system is in successful operation in several other cities, and it divides the work of the meter readers and the finance department equally throughout the year, making it unnecessary to hire extra readers and clerks for a short period when bills are due.

Pennsylvania County Votes Large Bond Issue.—Allegheny County, Pennsylvania, in which Pittsburgh is located, has voted a $43,680,000 issue for improvements. The specific amounts voted are as follows:

Roads	$ 6,550,000
Boulevards	10,930,000
County parks	1,500,000
Bridges	14,650,000
County office building	2,550,000
County auditorium	6,000,000
Airport	1,500,000

The total of $43,680,000 will be financed over a term of five years at an annual average cost to the taxpayer of 7/10 of a mill, or 70 ct. per $1,000 valuation.

Penetration Macadam

Construction Methods Discussed in Paper Presented at 1927 Highway Conference at University of Colorado

By L. I. HEWES

Deputy Chief Engineer and Director Regional Office U. S. Bureau of Public Roads, San Francisco, Calif.

Modern penetration macadam surface is a wearing surface not greater than 3 in., and usually 2½ in., compacted thickness, composed of clean, uniform sized broken stone combined with bituminous material introduced by the penetration process. Such surfaces are of course placed on adequate bottom courses and where necessary, particularly in New England, on deep sub-base and foundation courses. The present day construction of such top or wearing surfaces by the penetration method is vastly superior in all respects to former practice.

Modern Penetration Macadam Surfaces.—The modern penetration macadam road in the Northeast is built with a heavy stone or gravel foundation and an adequate base course of from 3 to 6 in. in compacted thickness, and the surface itself is composed of the very best stone obtainable at reasonable price, and the most minute care is exercised in all the successive steps of construction. In this connection it is well to note that the early portland cement concrete roads were not particularly good. They were not built with sufficient care, or under adequate inspection. In comparison to the modern type of portland cement concrete pavement construction, the original work now appears crude and sometimes even ridiculous. A parallel situation has existed with respect to bituminous macadam construction. The engineers in Massachusetts and Rhode Island and elsewhere now no longer attempt to build "cheap" penetration surfaces. They are building such roads at a cost of $20,000 to $35,000 per mile, and with excellent service to traffic and low maintenance costs. It is the object of this discussion to consider especially the place which bituminous macadam construction may have in the road development program of the western states, and to point out particularly the advantage which such type of construction has in regions of low rainfall or semi-arid regions where the expensive type of sub-base and foundation courses required by the wetter regions and regions of heavy frost are not necessary. The Bureau of Public Roads has recently awarded contracts in Arizona and California for approximately 50 miles of this type of construction.

Foundation and Base Courses—It is absolutely necessary that a penetration type of wearing course shall be placed on an adequate base course and foundation. It is customary to build the base course of good broken stone, and to fill it with screenings or other fines and develop its solidity by the methods of ordinary or waterbound macadam construction. Such base courses vary in thickness from 3 to 6 in., depending somewhat on the thickness of the wearing or bituminous top course itself, and upon the requirements of the location for sub-base or foundation. In the heavy frost sections or more unfavorable soils in the Northeast, there is always a heavy bottom or foundation course, frequently of broken field stone or of gravel, and 12 to 18 in. thick. In many sections of the arid or semi-arid West such foundation courses will not be required. This does not mean that there will not occur swampy or unfavorable spots on almost any project where heavy foundation will be needed, but there are many hundreds of miles of roads in the plain or rolling areas where drainage and soil conditions are favorable for an excellent natural foundation. It is particularly in such areas that penetration macadam should find favorable consideration.

Top of Penetration Course.—It is to the details of construction of the top wearing course or penetration course proper that attention is particularly directed. The result desired in this surface construction is a "lean" mosaic of relatively large stone without a "fat" or slippery condition. The old specifications in the East did not provide sufficiently large or uniformly sized stone. The best specifications now provide usually for stone 2½ in. maximum size, and 1¼ or 1½ in. minimum size. These sizes are standard for the hard stones known as traps. The desirable product is the one which tends to break in cubical form and without flat or splintered pieces, and one of the merits of trap rock is its tendency to so break when crushed. If trap rock cannot be secured, the hardest and toughest local stone is desirable. Preferably the stone for the wearing course should have a low coefficient of wear, or what is the same thing, a high French coefficient. Wear or loss by the Duval test is sometimes stipulated to not exceed 2 to 4 per cent. This is a rigorous requirement and cannot be fulfilled in many localities. But fortunately successful penetration work can be secured with softer stones. In all cases the stone must be absolutely clean and uniformly spread on the base course, and the base course is left sufficiently rough so that there will be an engagement or locking of the surface course stone with the base. It is readily seen that with 2½ in. maximum size stone spread to produce a compacted course 2½ in. thick, that the tendency is for the course to be a "one stone thick" course. As a result, the tendency for the surface to "shove" or "bunch" or to form waves is practically eliminated. The surface course stone is spread with greatest possible care by skilled workmen, and is rolled until it is thoroughly locked or until a mechanical bond is produced, and must present a uniform surface throughout. It must also present a surface with voids sufficient to take the poured asphalt. In the light of recent experiences, the attempts to pour asphalt into fine crushed stone now seem pitiful. Frequently the stone was so fine, that penetration could not be obtained. When the surface course has been thoroughly locked no travel or disturbance whatever is permitted until the first pouring of the asphalt.

If a relatively soft stone is used, which may show a tendency to crush under the roller, a larger size stone is preferable and stone passing a 3-in. ring and retained on a 1½ in. ring is usually specified. The exact adjustment of the size to the relative hardness is of course a matter of judgment. It should be understood, however, that the fear of producing a rough surface by the use of too large a stone in the surface course no longer exists. It is found that by the use of properly sized "key" or intermediate size stone, spread after the first application of asphalt, the roughness is removed and a rugged, durable, non-skid surface is produced. It should be noticed that a stone passing a 3-in. ring will not generally be 3 in. in all dimensions, and that the stipulation for a compacted 2½ in. surface course, using such large stone, is consistent. The details of inspection required by modern penetration work are exacting. The engineer must see that the rolled top course before applying asphalt is entirely free from dirt of any kind, including leaves or debris which may have blown upon the surface, and that there are no pockets of finest one resulting from a segregation of sizes in the process of hauling or dumping. All such pockets are removed and replaced by uniform size clean stone. The rolled surface must also present a true plane. Recently there have been introduced mechanical spreaders which are dragged behind trucks, which produce a uniform distribution of stone, but it is necessary for truck drivers to gauge carefully the necessary speed. Too much care cannot be given to the preparation of the surface course stone before applying the bituminous material.

First Application of Bituminous Material. — The bituminous material used in the East is relatively hard. The specifications in most instances require a penetration of from 85 to 100. With California asphalts, however, a softer material produces excellent results and it is found unnecessary to use quite as much as is standard in eastern practice. Rhode Island for the first pour applies 1¾ gal. to the square yard. In all cases the application is made by a motor tank distributor, under pressure and at a temperature of approximately 350° F. The pressure should be from 30 to 60 lb. per square inch.

There are many necessary details connected with this first application of bituminous materials to insure success. If any "fat" spots appear they must be dissipated by loosening the stones with an iron rod or pick to allow the material to penetrate, otherwise a lump appears in the finished surface. The nozzles of the distributor must be working freely and for the best results should be blown out with live steam before the distributor is operating. There must be no lapping of distributed asphalt and devices of troughs, tar paper, or sand are used to prevent it. Only truck operators skilled in applying bituminous material can achieve the necessary results. Asphalt must never be applied when there is any moisture in the stone or in wet weather, or at low temperatures, and the best results are obtained during warm weather in the middle of the day.

Key Stone.—Key stone is a clean, fine, hard stone, ranging in size from 1 in., more or less, to about ½ in., and the size is articulated with the range of sizes in the surface course itself. Rhode Island stipulates a size of 1 in. to ⅝-in. key stone when the top course is sized between 2½ and 1½ in. Only sufficient key or intermediate stone is applied to the penetrated course as will just fill the voids and permit rolling. After thorough rolling the excess key stone is swept off clean. It should be understood that the key stone is not an additional layer of stone, but merely a stone introduced in the voids of the surface course and not intended to take the wear. The wear should preferably come on the larger stone and the key stone is to lock the surface and "chink" the voids. No dust or foreign matter whatever is permitted in the key stone, and to avoid hauling over the compacted top course the key stone is stored in advance in piles along the shoulders. The distribution of the key stone on the penetrated top course must be absolutely uniform and never form a mat.

Seal Coat.—When the key stone has been applied, rolled and the surplus removed by sweeping, there is made a final application of asphaltic or bituminous material, formerly known as the seal coat. This application is usually about ½ gal. to the square yard, but may be slightly more or less, and is sometimes applied in two courses of approximately ¼ gal. each. It is not intended to create a smooth, glossy surface, but merely to insure a complete filling of the voids that may still exist after the application of the key stone. The seal coat is immediately covered with stone "chips" which are solid stone particles of from ⅝ to ⅜-in. in size. It is sometimes stipulated in the East that the chips shall be of trap rock even if it has to be brought from a distance.

Rolling.—A major essential to the success of penetration macadam surfaces is adequate rolling. Rolling is preferably concentrated on the surface course stone before the first application of bituminous material and should be continued until there is a solid lock of the particles but never beyond a point where waving of the stone surface recommences, or where there is a visible "rounding" of the edges. In relatively soft stones rolling of the first course may begin to break the stone and crush the surface, and thus develop a condition which would tend to prevent penetration of the asphalt. The moment this condition appears, rolling should stop. However, subsequent to the application of the asphaltic material and the key stone, rolling of the softer stone may safely continue.

In all cases what is known as "back rolling" should continue after the seal coat and chips or screenings have been applied. All the experts agree that rolling for several days after the road is opened to traffic is beneficial, and frequently where a road shows tendency to irregularity a re-rolling in the spring is also beneficial. Often with from one to three rollers on the job it will be observed that the actual rolling time is short. There is a tendency for rollers to be idle and it is well to have a check on the actual rolling time, and see that sufficient rolling is secured.

Conclusion.—This brief discussion is intended to indicate the direction in which lies success in penetration macadam work. It must be understood that the surface course above described must always be on a solid, adequate base course. On well drained roads, or desert roads, it is expected that penetration tops can be applied to old existing gravel or fine crushed rock roads with success. With sufficient sub-base or foundation courses, it is now common in the East to consider that penetration macadam will stand up under almost any traffic, including considerable heavy motor traffic, that is likely to come upon it. It is certain that for moderate traffic modern penetration surfaces are adequate. With the new specifications and the increased care in manufacture, the cost of maintenance has been greatly reduced and is not expected to exceed $150 per mile per year.

Western Penetration Jobs.—There is given below a brief abstract of the specifications and prices for three jobs for which the Bureau of Public Roads has recently opened bids:

Flagstaff-Angel Forest Highway Project in Arizona.—23.44 miles, 18 ft. wide, 2½-in. compacted penetration top on a nineteen-foot wide base of five inches loose fine crushed malpais (dragged and rolled and under traffic for a year or more). The top is also ledge malpais sized 2½ in. to 1¼ in., with key stone and screenings both ¾-in. to ¼-in. The asphaltic material is 90 to 95 per cent road oil furnished by the Bureau. Bids were opened June 30, 1925, and the price is 65c per square yard for top course in place, and the total cost per square yard including the base course is $1.16.

Grand Canyon National Park.—14.85 miles for which bids were opened Dec. 21, 1925. Two-inch compacted penetration top on 4 in. of ordinary macadam base, $1.25 per square yard complete in place. There is a long haul for stone. The base is 1 ft. wider than the top. The asphaltic material will be selected later by the Bureau. The base course stone is sized 2½ to 1¼ in., and filled with screenings ⅝-in. to dust. The top course is limestone 2½ to 1¼ in., and the key stone will be 1¼ to ⅝ in., and binder 1 to 1½ gal. for the first pour, and a seal of ¼ to ½ gal.

Yosemite National Park.—Bids were opened Dec. 28, 1926, for 15.15 miles of 2½-in. penetration macadam, on a 4-in. compacted macadam base, on disintegrated granite subgrade, and the low bid was equivalent to $1.25 per square yard complete in place. The top course stone is altered trap, sized 2½ to 1¼ in., with key stone 1¼ to ⅝-in., and a 90 to 95 per cent road oil will be used alternately with California asphaltic oil of penetration from 110 to 130.

Motor Traffic Roads in Germany

The road building conference, held at the Leipbig, Germany, fair, Aug. 28 to Sept. 5, was attended by numerous officials, engineers, and contractors. From the discussions it appeared that German experts no longer favor the building of long distance motor traffic boulevards, such as those originally planned between Berlin-Leipzig-Munich and Hamburg-Frankfurt-Basel. They consider, on the contrary, that boulevards exclusively for motor traffic need only be built on short stretches of particular importance, such as, for example, Leipzig-Halle or Cologne-Dusseldorf. For such stretches concrete roadways nine meters wide are recommended. Exclusive of such stretches it is believed that the existing net work of rural highways will suffice for motor traffic, provided the road surfacing is greatly improved.

In order to obtain the necessary funds for improving the roads and rendering them fit for heavy motor traffic, two new types of taxation were proposed. The first was an additional tax on automobiles to be levied by weight; the second a tax on automobile tires, of about 30 per cent ad volore, to be levied by the customs officials as the tires enter the country. Taxes on motor fuel were not suggested.

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

Our New Department

With this issue DISTRIBUTOR NEWS, the new department in The Gillette Construction Group of magazines greets the distributor and the manufacturer's representative. Following the Gillette policy of rendering the best possible service to our readers and advertisers, this department has been established to give prominence to the individual and trade news concerning the distributor.

It is our purpose to present in these pages (which will be found in every issue hereafter under the title given above) topics of interest to the distributor as they may relate to the manufacturer and contractor in the various fields which the Gillette publications cover.

We have named the department DISTRIBUTOR NEWS because it is all inclusive. Under this heading we hope to present news of all kinds as it pertains to this field. Space will be given to selling, shipping and service methods as they contribute to the growth of business and the promotion of goodwill competition.

The equipment user may think of the factory as the whole source of supply, whereas, due to the efforts of the distributor working with the manufacturer, machinery and repair parts are distributed throughout the entire country where the operator can obtain them on the shortest notice. Who the distributor is, where he is and how he renders service are a few points to be looked for in DISTRIBUTOR NEWS.

We should like to hear from our friends throughout the country with suggestions for these columns. If you have questions which you would like to have other distributors answer, send them in and we will run a Question Box to take care of them. Illustrations of warehouses, improvements, or pictures which tell a story will all be welcome. Photographs, too, will be used when for some reason someone is entitled to a special introduction to the readers of DISTRIBUTOR NEWS. These pages belong to you, let us hear from you. Communications for this department should be addressed to The Editor, DISTRIBUTOR NEWS, Gillette Publishing Company, 221 E. 20th St., Chicago.

Distributors Discuss Equipment Credits at Conference

Problems Discussed at San Francisco Banquet

THE Executive Committee of the Associated Equipment Distributors, which is the national organization of equipment distributors, held their semi-annual meeting in San Francisco Aug. 6 to 11.

During this meeting the committee went on record endorsing the principles being established by the Associated General Contractors on the elimination of false credits in the sale of construction equipment and pledged the support of their entire organization in conferences which are now taking place, sponsored by the A. G. C. on this matter, and their complete accord with the agreements which will be reached between the manufacturers and the A. G. C.

Composed of men prominent in the field of distribution of construction equipment, from an organization country wide in its scope, and themselves individuals who are executives of large firms, they recognize the mutual responsibility of the manufacturer, the distributor and the contractor, and they voluntarily assume their share of the load.

Edward R. Bacon of San Francisco, personally and as National President of the Associated Equipment Distributors, strongly endorses the work now being done by the Associated General Contractors and predicts the eventual working out of a harmonious plan which will be of great benefit to all concerned.

At the direction of the Executive Committee, Mr. A. C. Blaisdell, who is the Secretary of the Associated Equipment Distributors, will take part in the conferences being sponsored by the A. G. C. as their representative. Mr. Blaisdell has already taken a prominent part in the conferences to date and he is thoroughly sold on the merit of the plan of co-operation between the manufacturer, the distributor and the contractor, and is a strong advocate of the adoption of standard credit terms.

The Banquet.—On the evening of Aug. 8 the members of the Executive Committee of the Associated Equipment Distributors and the Board of Directors of the Northern California Chapter, A. G. C., were the guests of the Associated Machinery Merchants of Northern California at a banquet tendered them in the Palace Hotel. For this banquet the entertainment committee of the Machinery Dealers had provided unique table decorations in the form of miniature models of all kinds of construction equipment and a replica of a paved road.

Mr. L. E. Murphy of the A. L. Young Machinery Company was the toastmaster and after the introduction of the visitors short talks were made by a number of those present.

That the standardization of equipment credits is a matter of general interest throughout the country is indicated by the fact that at this banquet the brief remarks of everyone present concerned the activities of the A. G. C. in this field and the accomplishments to date in various sections of the country. Coming from all parts of the country the members of the Executive Committee of the Associated Equipment Distributors in their individual interest give a true cross-section of the country wide interest which now prevails in this work.

Significant were the remarks of Mr. Blaisdell of Cincinnati and of Mr. Hunter of Milwaukee.

Cincinnati Association.—Mr. Blaisdell stated that in his city, Cincinnati, all equipment dealers and distributors had formed an association and had agreed to abide by the terms of credit recommended by the A. G. C. They are exchanging credit information among

members and are overcoming the trade-in evil. On their part the Cincinnati Chapter of the A. G. C. had agreed that all members of the Chapter would place their orders for equipment through the local dealers instead of in other cities as had been largely the custom in the past and that the contractors would abide by the credit terms and not ask for unreasonable concessions in trade-ins, cash discounts, etc.

Wisconsin Organization.—Mr. Hunter told those assembled that in his state, Wisconsin, the construction industry was completely organized in the form of a Construction Industries Council. This council is composed of 25 branches of the industry, each branch represented by 3 men, a council total of 75 men. Taking part in the affairs of the council are such groups as the bankers, the machinery men, the material dealers, the lumbermen, the contractors, the insurance men, etc. Mr. Hunter further pointed out that in his state the construction industry accepts dictation from no one but on the other hand it dictates the policies which prevail, consequently they were not overridden with restrictive statutes and other hindrances to progressive business. He also declared that the construction industry in any other state if it ever expects to get anywhere must do likewise, that is, it must be a leader and not a follower.

Officers Present.—Officers and members of the Executive Committee of the Associated Equipment Distributors who were present at the meeting in San Francisco were as follows:

Edward R. Bacon, of the Edward R. Bacon Co., San Francisco, president.

Carl Borchert, of the Borchert-Ingersoll Co., St. Paul, Minn., second vice-president.

A. C. Blaisdell, of the Queen City Supply Co., Cincinnati, O., secretary.

Geo. F. Smith, of the Geo. F. Smith Co., St. Louis, Mo., treasurer.

J. W. Bartholow, of the J. W. Bartholow Co., Dallas, Tex.

O. B. Bjorge, of the Clyde Equipment Co., Portland, Ore.

Dan R. Brown, of the Brown-Bevis Co., Los Angeles, Cal.

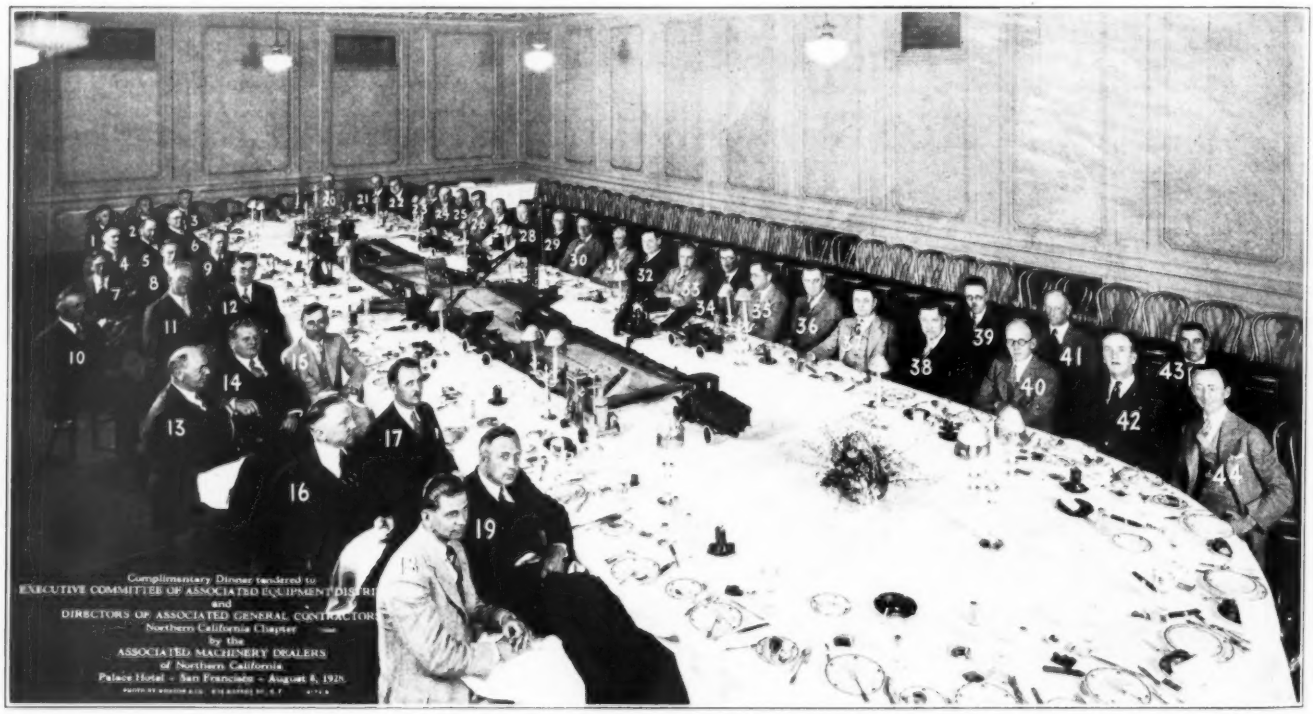
N. Floyd, Jr., of the Hubbard Floyd Co., New York City.

A. A. Fuchs, of the Fuchs Equipment Co., Omaha, Neb.

M. R. Hunter, of the Hunter Machinery Co., Milwaukee and Detroit.

H. G. Ferris, of the Hofius-Ferris Co., of Spokane, Wash.

Annual Meeting.—The annual meeting of the Associated Equipment Distributors will be held in Cleveland, O., on Jan. 13 and 14, 1929, just prior to the Road Show.


Complimentary Dinner tendered to
EXECUTIVE COMMITTEE OF ASSOCIATED EQUIPMENT DISTRI
and
DIRECTORS OF ASSOCIATED GENERAL CONTRACTORS
Northern California Chapter
by the
ASSOCIATED MACHINERY DEALERS
of Northern California
Palace Hotel - San Francisco - August 8, 1928.

Members and Guests Present at Banquet in the Palace Hotel

1. H. L. Hewitt, The Rix Company, San Francisco.
2. A. A. Fuchs, Fuchs Equipment Co., Omaha, Neb.
3. Al Hartley, Edward R. Bacon Co., San Francisco.
4. Carl Kratz, A. L. Young Machinery Co., San Francisco.
5. H. L. Terwilliger, Ingersoll-Rand Co., San Francisco.
6. E. S. Berney, Director, Northern California Chapter, A. G. C.
7. P. H. Curtis, Western Construction News, San Francisco.
8. E. S. Jenison, Jenison Machinery Co., San Francisco.
9. N. Floyd, Jr., Hubbard Floyd Co., New York City.
10. J. F. Knapp, Director, Northern California Chapter, A. G. C.
11. Edward R. Bacon, Edward R. Bacon Co., San Francisco.
12. L. E. Murphy, A. L. Young Machinery Co., San Francisco.
13. C. C. Chamberlin, Austin-Western Machinery Co., San Francisco.
14. F. C. Edmonds, Harron, Rickard & McCone Co., San Francisco.
15. J. W. Bartholow, J. W. Bartholow Co., Dallas, Tex.
16. C. A. Garfield, Garfield & Co., San Francisco.
17. Geo. F. Smith, Geo. F. Smith Co., St. Louis, Mo.
18. John Jorgensen, Contractors Machinery Exchange, Oakland.
19. Stanley Kulp, Ingersoll-Rand Co., San Francisco.
20. H. G. Ferris, Hofius-Ferris Co., Spokane, Wash.
21. W. W. Mutter, Northwest Engineering Co., San Francisco.
22. E. G. Lloyd, Manager, Northern California Chapter, A. G. C.
23. A. E. Mason, Norris K. Davis Co., San Francisco.
24. Carl Borchert, Borchert-Ingersoll Co., St. Paul.
25. Stuart S. Smith, Jenison Machinery Co., San Francisco.
26. R. W. Arns, Gardner-Denver Co., San Francisco.
27. Fred Stebinger, Edward R. Bacon Co., San Francisco.
28. D. M. Burgess, Schramm, Inc., San Francisco.
29. O. B. Bjorge, Clyde Equipment Co., Portland, Ore.
30. Bert Engstrom, Marion Steam Shovel Co., San Francisco.
31. Adolph Teichert, Jr., Director, Northern California Chapter, A. G. C.
32. J. S. Berkefield, O. R. Peterson Co., San Francisco.
33. M. R. Hunter, Hunter Machinery Co., Milwaukee, Wis.
34. Tracy W. Harron, Harron, Richard & McCone Co., San Francisco.
35. Jas. S. Caldwell, President, Northern California Chapter, A. G. C.
36. W. A. Mayther, Gardner-Denver Company, San Francisco.
37. Floyd O. Booe, Assoc. Mgr., Northern California Chapter, A. G. C.
38. A. C. Blaisdell, Queen City Supply Co., Cincinnati, O.
39. S. H. Wade, Western Construction News, San Francisco.
40. H. A. Olds, Edward R. Bacon Co., San Francisco.
41. Ed. Lietch, Lietch & Co., San Francisco.
42. Fred Weddleton, Western Road Show, San Francisco.
43. A. C. Becker, Schramm, Inc., San Francisco.
44. S. J. Clark, Edward B. Bacon Co., San Francisco.

Enroute

Mr. Earle S. Phillips, vice-president and manager of the Good Roads Machinery Company, Inc., Kennett Square, Pa., is on an extended trip to the Pacific Northwest. From that section the itinerary will include the entire Pacific Coast territory with a return by way of the southern route.

Mr. Phillips is making this trip to intimately study conditions in the various sales territories as relating to the products of the company, and visiting the direct representatives and dealers who represent the company from coast to coast.

The products of the Good Roads Machinery Company include rock crushers, elevating, conveying, screening and washing equipment. Complete sand and gravel producing plants, motor graders, hot oil distributors and a very complete line of snow plows for attaching to motor trucks.

An Old Firm with a New Name

Announcement has been received of the organization of The Bingham & Taylor Corporation. This company has taken over the foundry business established by Mr. Robert Bingham in 1849, and operated continuously since 1903 under the name of the W. P. Taylor Company. This foundry is one of the oldest of its kind in the United States, with a record of eighty years of continuous service.

Mr. James W. Gibney, for 26 years the Works Manager of the foundry, is the President and General Manager of the new corporation. Mr. Gibney states that the plant is equipped with three large cupola furnaces with a daily capacity of approximately 150 tons; two electric furnaces for the manufacture of high grade steel castings and crucible and reverberatory furnaces for the manufacture of brass and other alloys.

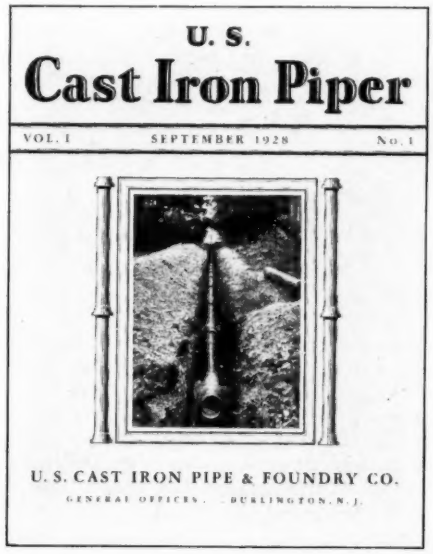
Soon after the founding of the plant by Mr. Robert Bingham, his son, Mr. Charles Bingham, was taken into partnership and the firm was operated under the name of Bingham & Son. In 1884 W. Perry Taylor secured an interest and has been identified with the company until the present time. With Mr. Taylor's entrance into the firm, the name became Bingham & Taylor, and was nationally known in the manufacture of gas and water works supplies. The company also manufactures railroad castings and general foundry products, many of which are known all over the world.

Mr. Taylor, now in his eightieth year, is retiring from business. He was formerly general superintendent of the Michigan Central Railroad, and is one of Buffalo's best known citizens.

The other officers of the new company are: Mr. William J. Gibney, vice-president, and Joe H. Gardner, secretary and treasurer. The office is located at the plant at 575 Howard Street, Buffalo.

A Piper on Pipe

Distributor News is very happy to introduce to its readers U. S. Cast Iron Piper, a brand new house organ published by the U. S. Cast Iron Pipe & Foundry Company. The illustration is a fac-simile of the attractive cover of



the first number of this paper. The editor's announcement reads:

"The United States Cast Iron Pipe & Foundry Company presents the 'U. S. Cast Iron Piper.' This magazine will be published quarterly and will contain articles and illustrations pertinent to the manufacturer and use of cast iron pipe and fittings, as well as sugar house equipment, fertilizer machinery, gas producers and other products manufactured by the company. The 'U. S. Cast Iron Piper' will be mailed regularly to those from whom requests are received."

This little magazine is handsomely gotten up, on heavy enamel paper, and is well illustrated. As to the contents, we will leave that for you to find out when you send for your copy.

Rebuilt Tractors Aid in Flood Control

The photograph shows two rebuilt Holt "Caterpillar" 5-ton tractors leaving the yards of McDonald & Burgman, "Caterpillar" dealers in Florida, for shipment to Louisiana, where Thompson & Moseley, Tampa contractors, are working on levee construction for flood control.

Rebuilt "Caterpillar" 5-Ton Tractors Leaving McDonald & Burgman Shops for Mississippi Levee Work. Sold to Thompson & Moseley

These old model tractors are taken in on trade and are torn down to the last nut and bolt. All parts are thoroughly cleansed in a large boiler filled with Oakite solution and the work of reassembling begun. Every part that shows signs of wear, or possible future failure are replaced with new parts. Cylinders are rebored, new bearings fitted and the entire motor made like new. The entire tractor is made new. The useful life is prolonged many years.

Mr. H. L. McDonald reports that the demand for "Caterpillar" tractors among Florida road builders and construction companies is growing, and rebuilt tractors as they are turned out at the Jacksonville shops are in great demand. Thompson & Moseley have five "Caterpillars" on their present contract.

Good News

To the people basking in the sun of California it is always a pleasant sensation, but local in its benefits. But, when the rays extend so that others far removed from the geographical limits of the state feel them they become a national asset.

Such is the reaction to the optomistic report on business conditions in Southern California recently received from Mr. H. G. Bley, president of the Construction Machinery Company, of Los Angeles. Mr. Bley reports that August of this year was the third largest month in the history of their business and was preceded by four or five months showing a marked increase. The volume of business in concrete mixers and hoists has shown a decided increase and the prospects are excellent for a big demand for revolving gas-shovels and portable compressors.

Mr. Bley's outlook for Southern California during the next three or four years is most optomistic and he predicts the greatest growth of any like period in its history. The Construction Machinery Company handle contractor's equipment and woodworking machinery. They are located at 455 East Third St., Los Angeles, Cal.

More Good News

The G. C. Phillips Tractor Company, Birmingham, Ala., report that their business for the first eight months of 1928 exceeds all previous years by a large margin. They are adding a number of well known lines and starting Jan. 1, 1929, they expect to handle a complete line of contractors' equipment. They state that they are in the market for additional lines and would be pleased to hear from the manufacturers of contractors equipment and road building machinery.

W. A. Riddell Company Holds Sales Conference

The W. A. Riddell Company recently held a three-day Sales Conference at Bucyrus, O., where their general offices and factories are located.

The entire sales force, with one exception, was present. Arrivals, making acquaintances and renewing friendships occupied the first morning. After lunch the men made a tour of the factory, and later films showing Warco road machinery in operation were exhibited.

At 6:30 the salesmen were invited to the Elks' Club, where they were guests of the company at a banquet. Mr. Geo. M. Schmidt, general manager, read a communication from Mr. Riddell, the president, wherein he expressed regret at his inability to be in attendance, but declared himself as being back of every salesman 100 per cent. Mr. Schmidt then introduced as toastmaster the new sales manager, Mr. N. E. Jersey. Mr. Jersey has served the company as designing and experimental engineer, chief engineer of track and grader department, and as sales engineer. His appointment, Aug. 1, as sales manager filled the vacancy occasioned by the resignation of Mr. R. O. Perrott. Mr. Jersey introduced representatives of the collection, accounting, credit, sales, advertising, roller, scoop, track and grader departments, all of whom gave the salesmen an insight into their particular problems.

Factory inspection and witnessing of manufacturing operations, occupied the second morning. The afternoon was given over to testing and demonstrating Warco road machinery on the proving ground near the company's south shop. In the evening the salesmen banqueted the officials and department representatives, and sponsored by Mr. Jersey, presented their side of the story.

The last day was spent in conferences with the credit and collection departments, and with individual sales conferences. After dinner an informal conference of the round table type was the order of the evening; it resulted in a closer understanding of each others problems by salesmen and home office representatives, alike. The conference was most successful, and the salesmen are enthusiastic over the plans of the company, and the future outlook of Warco road machinery.

$1,000,000 Chemical Plant for Tacoma

Construction work is now well under way for the new $1,000,000 plant for the Hooker Electro-Chemical Company on the 21-acre tract of land on the Tacoma tideflats. This is to be a main branch of the company located at Niagara Falls, N. Y. Construction will be speeded up so that the plant can be placed in operation by Jan. 1, 1929. About 150 men will be employed in this plant. The site has a frontage of 1,000 ft. on Hylebos Waterway and is easily accessible to deep sea vessels.

At the start the Tacoma plant will probably confine its operations to caustic soda and liquid chlorine, but its plans and facilities are designed for expansion as the growing requirements of the Northwest may provide markets for other chemicals.

The officers of this company are: Elon H. Hooker, president; Willard Hooker, vice-president and treasurer; H. M. Hooker, vice-president and sales manager; A. H. Hooker, technical director, and L. A. Ward, secretary. Albert H. Hooker, Jr., has been representing the sales and service work for the company on the Pacific Coast for sometime past.

Notes of the Trade

The following notes about men in the equipment and material fields, of interest to the distributor, the manufacturer, their men on the firing line, and those who buy their products, have been recently received.

Mr. C. Phillip Dearman has recently been appointed exclusive representative for M. V. Hendricks Company of Morenci, Mich., and the Chausse Oil Burner Company, Elkhart, Ind. Mr. Dearman's territory will include Illinois, Wisconsin and the northwestern portion of Indiana. Mr. Dearman is well equipped to handle these lines, as he is an experienced man in the oil and bituminous industries. Before assuming his present position Mr. Dearman was connected with the New Orleans Refining Company, and previous to that time served in the London offices of the Shell interests. Distributor News is glad of this opportunity to present Mr. Dearman to his fellow distributors. His Chicago office is located at 105 N. Clark St.

Chicago Pneumatic Tool Company announced the appointment of Mr. H. H. Sherman as manager of the Publicity Department, with headquarters at the general offices of the company, Chicago Pneumatic Building, 6 East 44th St., New York. The company is a large manufacturer of pneumatic and electric tools, air compressors, rock drills, engines, etc., having four plants in the United States, one in Canada, one in England and one in Germany, and other branches throughout the world. Mr. Sherman joined the company in 1927 as assistant publicity manager and has had years of experience in industrial advertising and advertising agency work. Mr. Sherman believes in trade paper and direct mail to secure results.

The T. L. Smith Company, manufacturers of mixers and pavers, announce the appointment of J. B. Harbison Equipment Company of Little Rock, Ark., as Smith distributors for their state. Mr. J. B. Harbison is well known to the trade, having been formerly associated with the O. B. Avery Company.

Paradon Manufacturing Company, Arlington, N. J., announce the appointment of Mr. Gerald Standish as assistant manager of sales. Mr. Standish will have general supervision of the sales of Paradon Chlorinators east of the Mississippi River.

Mr. J. W. Cliff has recently joined the MacGregor Valve Company in St. Louis as production manager. Mr. Cliff has had wide experience, holding important executive and engineering positions with such firms as the Power Accounting Company, Hyatt Roller Bearing Company, Wright-Martin Aircraft Company, Lehigh Accounting Company, Weston Instrument Company and for the last five years was shop superintendent manufacturing Merco-Nordstrom Valves. Under his jurisdiction the MacGregor Valve Company is having machines installed for quantity production of MacGregor Rotary Valves —the latest development in the lubricated valve field.

Mr. A. F. Barron, 30 N. Michigan Ave., Chicago, has been appointed sales representative for the Paradon Manufacturing Company, Arlington, N. J. Mr. Barron will have charge of sales and service of Paradon chlorinators in the states of Illinois, Indiana and southern Wisconsin.

Mr. W. J. Dunn, Sr., of the Dunn Machinery Company of Atlanta, Ga., signs his letters "Yours very truly, year after year." This company has been in business for 38 years and carries machinery for factory, mill and farm, as well as waterworks equipment. Mr. Dunn is a seasoned machinery man.

The J. B. Harbison Equipment Company, of Little Rock, Ark., has purchased the branch holdings of O. B. Avery Company now located at 209 Spring St. The O. B. Avery Company's main office, located at 1325 Macklind St., St. Louis, will be maintained by them, where they will continue their well established service organization. The J. B. Harbison Equipment Company handle Northwest Shovels, Smith Mixers, Williams Buckets, Butler Bins and Chicago Automatic Conveyors.

A letter from The Trackson Company, Milwaukee, Wis., contains the following interesting items: Recent distributor appointments—Wm. Ford & Co., Inc., 15841 Second Blvd., Highland Park, Detroit, Mich.; Industrial Power Co., 2618 Fond du Lac Ave., Milwaukee, Wis.; Industrial Tractor Sales Co., Inc., 180 N. Michigan Ave., Chicago; Hooper Equipment Co., 523-527 E. Washington St., Indianapolis; New England Implement Co., 19 Jersey St., Boston; and 22 Garden St., Worcester, Mass. These companies handle all lines of Trackson equipment for McCormick-Deering Industrial Tractors, consisting of Trackson full-crawlers, loaders, cranes, shovels, etc. They will also carry stocks of repair and replacement parts and will be able to give prompt service to users and owners of these machines.

Snow Removal Equipment Useful for Clearing Streets in Any Community

Equipment That Will Be Supplied by Manufacturers for the Coming Season

THE WINTER of 1928-29 will soon be upon us. In 36 states of the Union and throughout the Dominion of Canada, municipal officials will be called upon by the business men and the home owners to keep the streets clear of snow throughout the heaviest snowfalls, or at least to clear the way after the storm has ceased, in order that buyers may reach the merchants' stores, that employees can reach their employment, that the children may attend school without inconvenience, in order that supplies can continue to be delivered without hindrance, and in order that the police and fire departments may well continue to afford protection throughout the city. The direct financial loss occasioned by unremoved snow is enormous. In New York City, one storm alone cost the merchants approximately $60,000,000 a day. In Chicago, a single storm in 1918 caused a loss in trade of $20,000,000 to downtown stores. The losses in a smaller community, while smaller, are proportionally as great, and every bit as serious to each merchant involved. Two inches of unremoved snow on the streets of a city will be found sufficient to seriously impede traffic and bring about business losses. The surface lines in New York City, in one winter, lost one million dollars in fares due to the inability of riders to get to work. Too, a municipality with a recognizable rural trade will find it to its interest to insist upon keeping the roads open that lead to the community, in order to keep this desirable trade that would otherwise cease altogether during the period of blockade, or be diverted to a more farsighted community that could be more easily reached. The rural task will fall to county and state, but should be insisted upon by the community that would reap the benefit.

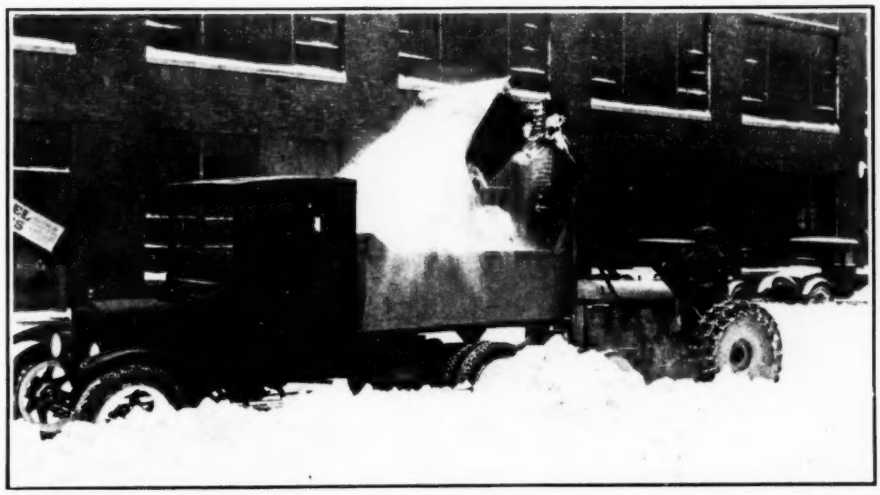
While the cost varies widely with the amount of snow to be removed, the snow removal equipment used, and the methods and management brought into play, it will be found that the cost is an investment well worth while, an investment that will be repaid ten-fold in maintenance of business and the flow of the normal life of the city.

While costs and methods and management will be largely discussed elsewhere in Municipal News and Water Works, the information in the following pages will afford municipal authority a good picture of the types of equipment that will be found available this season for snow removal work, and will indicate the ways in which the various machines have been used to good advantage.

A Baker Plow Mounted on a Commerce Motor Truck on City Work

Baker Snow Plows.—The large line of Baker Snow Moving Equipment manufactured by The Baker Mfg. Co. of Springfield, Illinois, includes both "V" and blade types. Snow plows are made for attachment to leading tractors and standard motor trucks. Among the many models, are the well-known Patent Trip Blade Snow Plows for motor trucks which permit use on pavements likely to contain obstructions such as man-hole covers, car tracks, etc. When the blade strikes the obstruction it swings back and, upon passing, trips back instantly thus not injuring truck or plow. These blades are in sections of about two feet wide. Other models include snow plows for McCormick-Deering and Fordson tractors up to those for Five-Ton, thirty, Ten-Ton and sixty. The heavier plows are hydraulically operated. Special speed plows both "V" and blade type have been developed for use with motor trucks employed at great speeds. In every Baker Snow Plow there is evidence of a desire on the part of the manufacturers to make snow plows of unusual strength, a snug fit on the truck or tractor and the maximum of convenience in its operation.

North Hydraulic Digger.—The North Hydraulic Digger, manufactured by the W. M. Blair Mfg. Co., 3673 Michigan Ave., Chicago, Ill., is designed to lift piled snow from the street, in loads of one cubic yard, and elevate and dump this snow into a motor truck or dump



A North Hydraulic Digger Loading a Motor Truck on Municipal Snow Removal Work

wagon. The lift is 90 in. This machine is said to be capable of loading from 300 to 500 cu. yd. of snow per day. In the summer the same outfit is used for digging and handling other material.

The power unit of this machine is the Fordson tractor, and the digger can therefore be operated by anyone who can operate the Fordson. Only one man is needed in its operation. The tractor is equipped with rubber tired wheels for this service, for operation on city streets. The lifting action is accomplished by means of a hydraulic hoist at the front of the tractor.

Barber-Greene Snow Loaders.—Cities should think of Snow Loaders as insurance against loss from snow. Fire engines do not pay for themselves by daily work, but rather by being on hand when needed. It is the same with snow loaders; they frequently pay for themselves in one storm.

Comparative figures show that a snow loading machine will do the work of 50 to 200 shovelers, that it will work tirelessly day and night, that it costs very much less, and that it is remarkably faster. It is good business to use snow loaders.

There is no longer any need to put up with the delays caused by snow, because it can be removed quickly by modern machinery. Barber-Greene Snow Loaders manufactured by the Barber-Greene Co., Aurora, Ill., have been used successfully for eight seasons in the largest cities in the country, and in many smaller ones.

Mechanical loading methods other than with a Barber-Greene have been tried, but none of them, it is claimed, have been able to approach the 10-hour record made in Albany, when a Barber-Greene loaded more than 2,000 cubic yards into trucks or the average of 1,600 cubic yards maintained by the Boston Elevated Loaders, and similar performance by all other Barber-Greenes.

In two of the cities where other loading machines were said to have been successful, Barber-Greenes have since replaced them.

Three machines are necessary for the quick removal of snow; they are: The snow plow, the snow loader, and the motor truck.

A snow plow quickly clears a path to permit some traffic and at the same time piles snow into windrows for the snow loader. The snow loader picks up the snow and loads it into trucks which haul it away. This procedure is practical, simple, and fast.

It utilizes the trucks to their maximum capacity and can be continued almost indefinitely. The maximum continuous run was maintained in Boston, when a Barber-Greene Snow Loader loaded trucks for 112 consecutive hours.

The storm which called out the Barber-Greene machine in Manchester for the first time was one of the worst blizzards experienced for more than

Two Views of Barber-Greene Snow Loader at Work in a Snow-Clogged Municipal Street

two years in a country where the average snowfall is more than 60 in. in a winter. In 48 hours 21 in. of snow fell. A fierce wind caused drifting and tied up the train and trolley service throughout the country.

With a big tractor snow plow to windrow the snow into the gutters and a Barber-Greene to load the snow into trucks, the City of Manchester soon emerged from its snow cover.

Trucks were driven along with the traffic until they reached the snow loader which worked in the opposite direction. Loaded trucks moved without disturbing traffic.

Other snow handling equipment machines owned by this enterprising city are: One Holt 10-Ton Tractor equipped with a Sargent tractor-plow; four Champion Blade Plows which are attached to 5-ton trucks such as White, Mack, Packard, and Federal; one Sargent Truck Plow.

Madison, Wisconsin, having an average annual snowfall of 35 in. and a population of 40,000 is too big to allow blocked streets. Business in Madison suffers from a snow blockade in relatively the same degree as the largest city in the country. In Madison the city officials considered the city too large to allow snow to get the better of them. They now have a Barber-Greene Snow Loader.

And on the other hand, the city is small enough so that the snow problem can be almost completely solved by the application of one Barber-Grene. A city which uses 50 to 200 shovelers to remove snow can solve its snow removal problem almost completely by the purchase of one machine. In this way, a medium sized city can solve its snow removal problem more easily than a larger city which must purchase several machines to replace thousands of shovelers.

Fox Snow Loader.—Here is a loader that will dig and load snow into motor trucks in a single operation. It is said to load at the rate of 100 yds. per minute, and travel at the rate of ½ to 15 miles per hour. This loader, which discharges into a truck at either side or rear, is made of steel throughout, and equipped with Hyatt roller bearings. The esculator can be raised or lowered automatically in 10 seconds, say the manufacturers. If trucks are not available, the snow can be cast to the side of the pavement. In Chicago, one of these loaders could load a truck in 35 to 55 seconds, and kept 10 trucks busy. In Cleveland, the machine loaded 420 trucks in an 8-hour shift after one storm, with each load about 6½ cu. yds., according to the manufacturers. This loader is manufactured by the Fox Rotary Snow Broom Co., 2 La Fayette St., New York City.

Mattson Snow Fence.—While primarily used in rural districts, snow fence has its applications inside the corporate limits of a municipality as well. On the outskirts of any community, and in many parks, there are locations devoid of structural improvements where the winter winds cause the unusual formation of heavy drifts on streets and sidewalks. These drifts greatly increase, at times, the work of the snow removal forces. The careful use of snow fences at these locations, in regions of heavy snowfall, will often cause the formation of the drifts on vacant lots or at points in the park where they will do no harm, diverting these drifts from the roadways. The fencing is readily removed to storage in the spring, and easily erected in the fall. One successful type of snow fence is that manufactured by the Mattson Wire and Manufacturing Company, Joliet, Ill. This fence is made of heavy hardwood pickets woven between the best grade galvanized Bessemer steel wire, according to the manufacturers. The wire is tightly twisted to prevent slippage of the pickets, and pickets have their tops perfectly even. This type rolls up in convenient lengths and is easily installed in the late fall and removed in early spring.

Link-Belt Snow Loader.—The photograph on this page shows a Link-Belt "Grizzly" loading snow into 5-ton trucks on the Parkway in Philadelphia, at the rate of a truck in a little more than a minute.

The machine, designed and built by Link-Belt Company, Philadelphia, turns completely around in practically its own length—a feature of real advantage on a thoroughfare such as the one on which it was working. Heavy crawler treads, together with a reserve of power, enable it to walk into the snow; its construction is such that the snow is gathered and brought to the buckets almost without the assistance of hand labor, according to some claims that have been made by the manufac-

turer. There were but three men working with the machine—one operator and two to clean up.

The use of this loader is determined only by the season, as in warmer months, or during one of those seasons known colloquially as "an open winter," this same machine will be found handling sand, stone, gravel or coal.

Haiss Snow Loader.—The Haiss Snow Loader shown in the photograph is one owned by the City of New Bedford, Mass., shown at work during their snow removal campaign. It is used to load piled snow into motor trucks.

Haiss Snow Loaders, manufactured by Geo. Haiss Mfg. Co., New York City, are said to have a loading capacity of 10 to 15 cu. yd. per minute. They are equipped with feeding and cutting propellers which cut a swath 8 ft. wide and as the Loader is equipped with a slow speed worm drive that pushes it into the pile at a speed of 9 ft. per minute, this combination will dig not only snow but frozen snow as well as ice, claim the manufacturers.

It is equipped with a 41 HP. Waukesha engine having a Ricardo head, is creeper mounted and will travel anywhere. It is equipped with the Haiss manganese feeding propellers and clean-up scraper to do away with the pick and shovel.

The mounting is the Haiss Creeper chassis and the Snow Boom is of the flight type of steel plate trough 33 in. wide equipped with flights 11 in. high, 24 in. apart, carried by manganese elevator chain. The crowding speed is 9 ft. per minute which can be used for heavy digging or 65 ft. reverse speed for light digging. The elevator boom is adjusted by the Haiss worm and jack knife raising device which means the operator can raise the boom quickly if necessary. The flights are ¼ in. steel plate, bent to give a cutting action on the tail shaft, and are equipped with teeth.

Joy Snow Loader.—The Joy Manufacturing Company, of Franklin, Pa., holding basic patents on a mechanical gathering device, has developed a loading machine for decreasing the cost of snow removal from city streets. The working head of this machine is an exact duplicate of the well-known Joy device, which is used by the coal industry.

The Joy Snow Loader has capacities for any character of snow and will load from 10 to 20 cu. yd. per minute. The design and construction of this unit is based upon the extensive manufacturing and field experience gained by the solution of widely varying mechanical loading problems.

Operated by one man, at high gathering and delivering speeds, over any kind of paving, the Joy Snow Loader is designed for rapid clearing of streets and roadways, and for loading fresh or frozen windrows of piled ice and snow into trucks. The machine consists of two main units.

Link-Belt "Grizzly" Loader Handling Snow in Philadelphia

A steel chassis mounted on solid rubber tired wheels, carrying a Hercules Model "G" four cylinder gasoline power unit, operative at 6 speeds forward and 2 speeds reverse, with forward speeds ranging from 74 ft. per minute to 12 miles per hour.

A steel conveyor frame mounted on the chassis at adjustable angles for operation, and for low clearance when traveling, carrying the Joy patented gathering mechanism, consisting of two rotating arms which sweep the material

Haiss Snow Loader at Work in New Bedford, Mass.

The Joy Snow Loader, Recently Introduced

into the conveyor delivering to trucks through a swing chute.

Gettelman Hi-Speed Snow Plow.—The Gettelman Hi-Speed Snow Plow manufactured by the Heil Co., Milwaukee, is an example of modern snow removal equipment. Modern snow removal programs place high speed snow plows on the pavement soon after a snow storm begins and, if the fall is heavy, the plows stay on the job twenty-four hours per day until the storm subsides and the highways are cleared. Not only is this method less costly, but the thoroughfares are actually open all of the time, full width, instead of being blocked for days following a storm. State Highway Departments find that tax revenues from increased gas consumption, made possible by open highways, actually pays for the removal of snow under this plan.

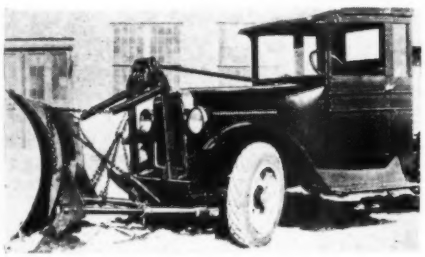
Any truck of two tons' capacity or larger can handle a Gettelman Snow Plow at 20 miles per hour or faster. Dry snow has been handled by two-ton trucks traveling at 35 miles per hour, and wet snow at a slower speed, depending on the depth of the snow, say the manufacturers. Snow that weighs 45 lb. per cubic foot is considered as wet snow.

Traveling in wet or dry snow at the speeds mentioned, the snow will run up the curved blade in a sheet and spread itself evenly across the roadside and into the field much like a sheet of water spread by a speed motor boat or hydroplane. The snow from one storm spread in this manner does not pile up a windbreak that would cause the snow from a second storm to immediately drift into the roadway.

One county, with nine Gettelman plows attached to their regular road-building and maintenance trucks, following this program keeps more than 250 miles of main traveled highways open at all times. For side roads and emergency service several tractor units are maintained, but these nine plows cost less than one heavy duty V-shaped plow and tractor.

The Gettelman Hi-Speed Snow plow is made in 9-ft. lengths for 1½ to 2½ ton trucks and in 10-ft. lengths for 3-ton truck and larger. All blades are 38 in. high. For light duty trucks short push arms place the center of the blade 46 in. from the center of the front axle. Longer push arms for heavy duty trucks make this distance 56 in.

Steel plate 3/16 in. thick is used in the blade. The cutting edge is made of high carbon steel and this plate is reversible, thereby doubling its life. Structural steel angles reinforce the curvature of the blade and the cutting edge. The push arms are telescopic, seamless steel tubes affording maximum strength at minimum weight. A universal front axle attachment secures



Blade Type Gettelman Plow Mounted on Front of Motor Truck

the pusher arms to any make and model of truck. The hoist frame, winch, and cab control rod are light but sturdy in construction, and the plow is easily raised to carrying position because the worm and gear are machine cut. Tension type springs are easily adjusted to plowing conditions. All castings are electric steel, thoroughly annealed and machined to jigs, assuring standardization of parts.

The installation of the plow on any truck requires only a few hours and is said to be a very simple job. Once the installation is made, it requires only a few minutes to detach the plow or attach it again, according to the manufacturers.

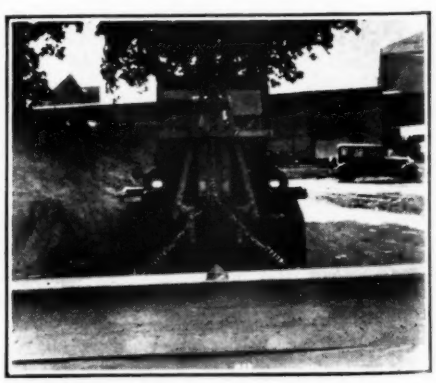
There are but three possible positions for the blade, and these have been predetermined by scientific tests. The telescopic push arms permit quick adjustment of the blade to throw the snow to either side of the road, or the blade may be adjusted squarely across the front of the truck for bull-dozing snow at street intersections or other wide areas.

One of the features of the plow is the tripping action of the blade which protects it against damage from any obstructions it might hit. The blade is pivoted to the push arms so it can tilt forward, and the tension springs and the counter-balancing effect of the snow brings the blade back to the scraping position immediately. The deeper the snow the more it helps to return the blade to the operating position because the pivoting point is below the depth of the snow against the blade.

Another feature is the offset of the blade in respect to the truck. The discharge edge extends a foot beyond the truck wheels. This offset minimizes the side draft because the pressure of the snow on the offset portion of the blade throws the pressure line to the rear of the steering knuckle of the front wheel. This tends to make the truck nose toward the discharging snow instead of away from it. Then, too, the truck can stay on the pavement and still clear the snow beyond the edges of the concrete. With chain drive trucks it is possible to plow close to the curve and yet keep the snow from getting into the chains and causing extensive wear of the jack shaft bearing. The correctly predetermined angle of the blade also minimizes a side draft.

For municipal work the plow can be operated to pile the snow along the curb for removal.

Pneumatic Snow Plow Lift.—The Good Roads Machinery Company of Kennett Square, Pa., for years the pioneers and leaders in the snow plow industry, in collaboration with the White Motor Truck Company and the Westinghouse Air Brake Company, has developed and placed on the market a pneumatic lift for snow plows attached to trucks and busses that is unique and novel. It is believed to be the first application of compressed air for the function of raising and lowering a snow plow suspended from the front of a motor vehicle, it is said. Prior to this development a second operator has been necessary on the driver's seat for the sole purpose of operating the manual



General View of Champion Model 10-C Blade Type Plow on White Truck, Equipped With Pneumatic Lift Outfit

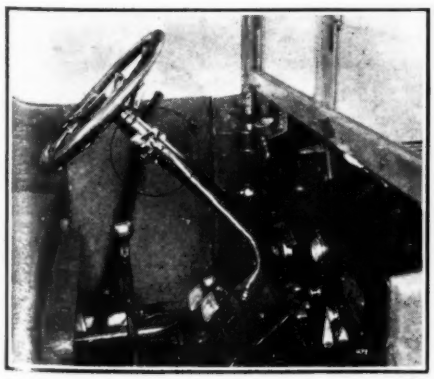
lift device of a snow plow. This entailed considerable added expense for comparatively intermittent and unskilled service, but absolutely necessary as it was out of the question to add this to the duties of the driver. This particularly applied to busses and made the problem here especially difficult, because, at best, no space was available for the plow operator. The simplicity and economy of the Good Roads-Westinghouse Pneumatic Lift insures its quick adoption by bus companies, truck operators, highway departments, transit companies, and others. The driver can subconsciously operate the snow plow by means of an air valve and a latch rope, without distracting his attention nor adding to his physical efforts.

The lift is operated by a vertical Westinghouse air cylinder attached to the "A" frame clamped to the chassis in front of the radiator. It is easily substituted for the prevalent hand hoist on existing plows. The lift chain is automatically locked when the air is shut off, but can be quickly released by pulling the trip rope. Trucks and busses equipped with air brakes require no further attachments than the air cylinder and lock. Those not equipped with air brakes can, with a modest expenditure, attach a compact Westinghouse Air Compressor to the timing gear box on the motor and the necessary air tank to the chassis. Tests show the time required to raise a plow with this device is counted in seconds instead of minutes formerly consumed by hand operation, the manufacturers claim.

It is common practice to leave the "A" frame on the front of the truck or bus during the snow season, as only a few minutes are then required for hooking on the plow when needed. However, the "A" frame is also readily removed when desired. This Good Roads-Westinghouse unit is suitable for any type of snow plow,—one-way, V, shovel nose, etc.

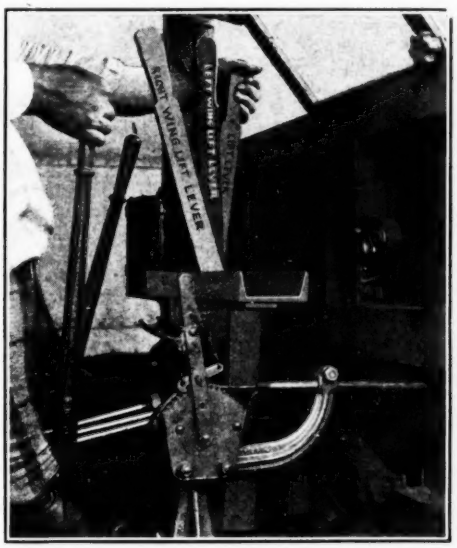
The entire combination is covered by patents and patent applications.

LaPlante-Choate Plows.—The greatest improvement which has been added to the snow plows manufactured by the LaPlante-Choate Manufacturing Co., of Cedar Rapids, Iowa, in recent years is an improvement added this year, namely, the putting of the hydrawlic controls in the cab of the tractor where the entire plow may be operated entirely by the tractor-driver. This feature eliminates two or three men ordinarily required to operate a snow plow, and it also enables the tractor driver to speed up his work considerably, the manufacturers claim.



The Control of the Pneumatic Lift Device

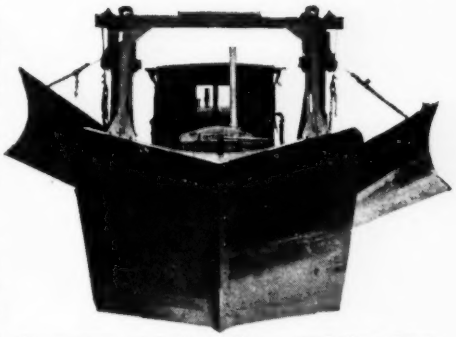
With hand-operated plows it is necessary to stop the tractor in order to make adjustments on the wings or "V". The wings on a snow plow have the same effect on the operation of same that the oars have on a boat, as far as side-draft is concerned. If you drag one oar, the boat turns in that direction, and the same is true with the wing on a snow plow. Consequently, since plows are generally operated in varying depth of snows, it is essential that the wings be raised and lowered frequently, to permit the tractor to maintain its forward motion without interruption. The tractor driver himself, is the only person who knows when the forward progress of the tractor is being impeded by a wing dragging, and consequently, he should be in a position to raise or lower the wing which is causing his trouble, and to do it instantly.



View of Controls on LaPlant-Choate Snow Plows

With these new hydraulic controls in the cab of the tractor, he can raise and lower the wings instantly, without stopping the tractor. He can also assist the operation of the plow materially in other respects.

The mounting used on LaPlante-Choate plows, is such that the entire weight of the plow can be placed on the tractor for transportation or when needed to increase the traction. For instance if the tractor operator feels that the tracks are slipping in the soft snow and ice, all he needs to do, is to throw the lever which raises the plow and raise the plow up about an inch, and thus throw the entire weight of the plow on the tractor This weight will add traction to the tracks of the tractor, and in most cases prevent their slipping.



Front View of LaPlant-Choate "V" Type Snow Plow

Trackson-Sargent Plow. — A snow plow unit which is attracting attention this season among those who are familiar with snow removal methods consists of the McCormick-Deering 10-20 Industrial Tractor, with Model DH Trackson Full-Crawlers, and the Sargent Snow Plow which is especially adapted to mounting on this crawler tractor. This is manufactured by the Trackson Company, Milwaukee, Wisc.

Neither of the machines which compose this unit is new in itself, but the combination is a recent development of interest. Highway officials, contractors, engineers, etc., are already familiar with the McCormick-Deering Industrial Tractor, the Trackson, and the Sargent plow.

The ample power provided by the McCormick-Deering takes the plow through deep, hard-packed snow or loose, fresh drifts, with the Trackson Full-Crawlers giving the unit positive traction, light ground pressure, and sure footing, say the manufacturers.

This model of the Sargent may be used either as a wing or as a V-plow. For an average fall of snow the wings may be spread to their full width of 17 feet, and for very deep, packed drifts they may be raised entirely and brought in close to the tractor, so that only the V-blade is left to plow the first channel. Or, when it is necessary to push back only one bank, either wing may be lowered and spread while the other is kept in the raised position, so that all of the power of the tractor is directed to the lowered wing.

Another feature of this plow is the fact that the V-blade may be let down so that it plows the snow right to the ground, or it may be raised an inch or two so that it will leave enough snow on the roads for sleighing.

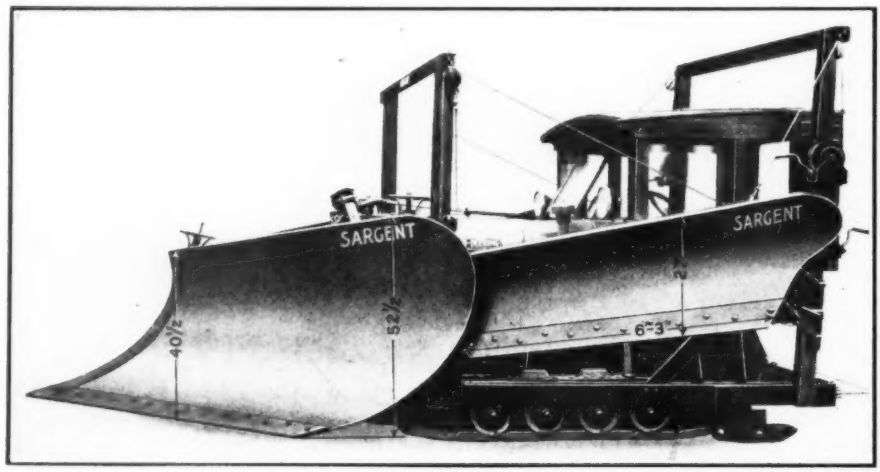
One of the most important advantages of the Trackson McCormick-Deering snow plow unit is the fact that at the end of the winter season the Sargent Plow can be removed quickly and easily, and there will remain a 3½-ton crawler tractor ready for road construction or maintenance jobs, land clearing, dirt moving, and the countless other jobs which public works involve.

This year-around usefulness is a big factor in the economy of any snow removal equipment, for most communities cannot afford to use a machine for only a few months and have it remain idle in storage for the rest of the year.

Crane Loads Truck.—Cranes such as the Universal are often used for loading piled snow into trucks. The Universal has been used in several cities such as Detroit, Chicago, Syracuse, Utica, Rome, N. Y., New York City, etc. In New York City, as many as thirty motor truck mounted Universal Cranes have been used during the heavy snow months of latter January and February.

The photograph shows such a unit operating on Broadway in New York City.

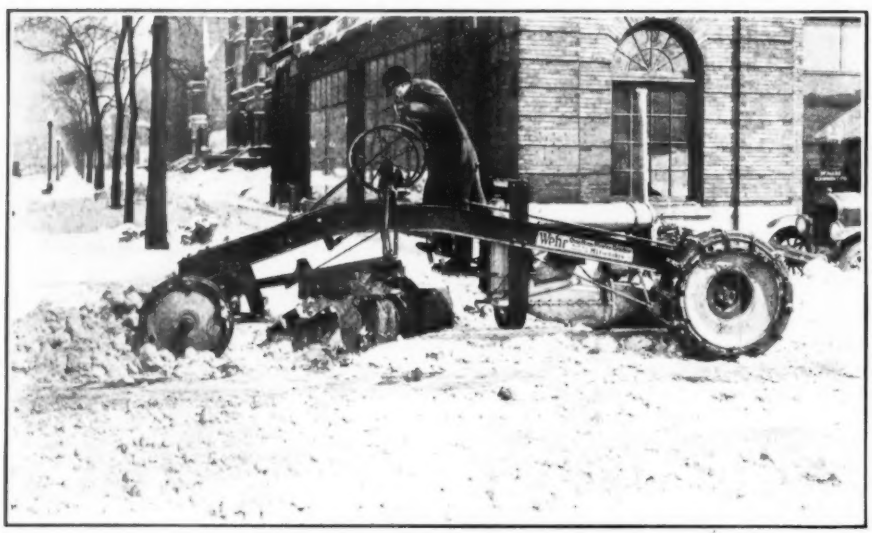
Various data collected on the ability of these machines to handle snow, according to the manufacturers, shows that they can easily load an average of 9 to 10 cubic yards into trucks in 2½ to 3 minutes. In the city of Syracuse, the commissioners of Public Works, stated that the city machine saved $2.00 a truck load on loading the snow. The usual procedure in using the crane unit is to clear the streets of the snow piling it into the big windrows at the side of the streets which are then loaded by the crane unit. One and a half cubic yard snow buckets are used on the crane, and the trucks can be equipped with high side boards so that they can haul nine to ten yards at a trip. One of the main advantages of the unit is that after the snow freezes and the piles get rather hard the clamshell action of the snow bucket is able to bite through without very much difficulty and handle the frozen snow and ice. Occasionally the units have been equipped with ¾ yd. digging buckets and teeth to handle some of the exceptionally hard packs of icy snow.



The Sargent Snow Plow Mounted on the Trackson-McCormick-Deering Unit

Universal Crane Handling Snow on Broadway, in New York City

Another feature of the unit is the motor truck mobility so that they can become busy on various other jobs when they are not required for snow removal work, and can be easily transported into congested districts when the storm suddenly comes up. The Borough of Queens, New York, has recently purchased four Universal Cranes, all motor truck mounted, to be equipped with 1½ yd. snow buckets in reserve for snow removal work in New York and vicinity this winter. These units, like other Universal Cranes, are adaptable to 101 other uses throughout the balance of the year. This crane is manufactured by the Universal Crane Company, Lorain, Ohio.



Wehr Grader at Work Clearing a City Street

Wehr Graders.—These graders, manufactured by the Wehr Company, Milwaukee, Wis., are used with a scarifier to remove ice, and with the grader blade to windrow the snow and any ice that can be moved by this means. These are one-man power graders built around a light tractor, and are useful for patrol purposes in the summer. A typical instance of ice removal has been reported from Queen Victoria Park, Ontario, Canada, next to Niagara Falls. At this location the spray from the falls collects on the main driveway, and in the winter as much as 6 to 18 in. of ice will form on the drive in the course of one night. This drive is 36 ft. wide and the section subjected to this

ice formation is 1,500 ft. long. The ice is first broken up with the Wehr grader equipped with a nine tooth scarifier, this operation taking about one hour with 12 in. of ice. The blade was next used, and the ice removed in about two hours. This method saved about two days time over pick and shovel methods, and the saving in cost was reported to be about $150,000, and the road was kept open. On ordinary snow removal, this grader is said to keep from 18 to 20 miles of road open throughout the season at a cost of less than $8.50 a day.

Walter Snow Fighter.—A photograph on this page shows the Walter Snow Fighter with the patrol plow and the center scraper pressure blade and equipped with a low level type of dump body, as extensively used by cities and municipalities.

The Walter Snow Fighter manufactured by the Walter Motor Truck Company, Inc., Long Island City, N. Y., has been especially designed and constructed for snow displacement service. There is a positive drive to all four wheels under all traction conditions. This is obtained by means of patented automatic lock differentials. The motor is of the heavy duty six-cylinder type and developing over 100 H. P. This, together with the special 10 to 1 range transmission, makes possible maximum speed for all snow conditions.

The front plow has been designed to pour and throw the deep snow off the road and out of the way. The center pressure scraper blade can scrape right down to the road surface removing all packed snow and ice. This center pressure scraper blade is provided with suitable cushion springs to prevent damage.

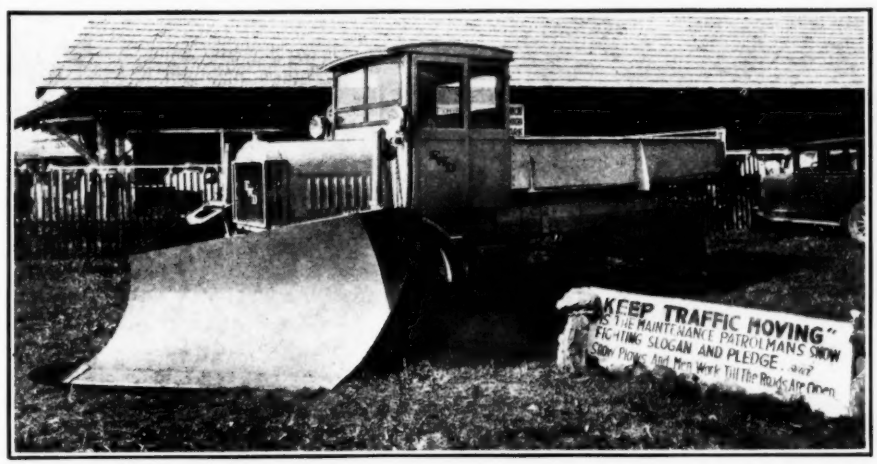
These units are equipped with dump bodies either of the sand and gravel type or special garbage type or with flusher tanks and road oiling equipment so as to make them servicable the entire year.

Bucyrus-Erie Shovels.—Some municipalities have made use of a steam shovel or gas shovel for picking up snow piled along the curbs and loading this snow into trucks to be hauled away to the dump. This is said to be a good method. A photograph in this issue shows a Type B Bucyrus-Erie shovel doing this work in the city of Boston. The shovel is standard. It is often the practice when using shovels for snow removal work to replace the standard dipper with a special one of about 4 cu. yd. capacity that has been developed for the purpose since snow is a relatively light material except when it has been converted to ice by a thaw followed by a sudden freeze before the removal work can be completed. Thus, in an emergency, a shovel can always be rented and relied upon to do good service. This particular shovel is so well known as to need no description at this time. It is manufactured by the Bucyrus-Erie Company, Erie, Pa.

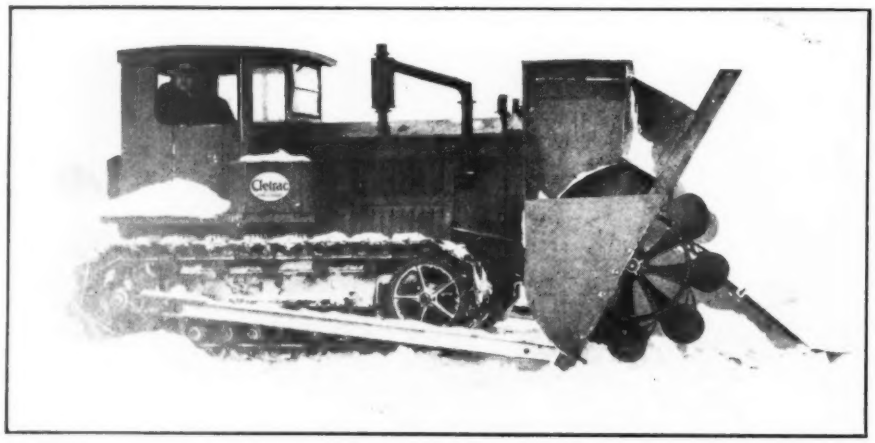
FWD With "V" Plow.—At the Missouri State Fair this year, the Missouri State Highway Department exhibited as one of their types of snow removal equipment a FWD truck equipped with the "V" type plow shown on this page. This is a high speed plow that throws the snow to the side of the pavement for future attention, and is equally applicable to municipal work, where the snow is first piled along the curb by such plows and then loaded into trucks for disposal. The FWD truck is manufactured at Clintonville, Wisc.

The Walter Snow Fighter, a Truck Type Plow

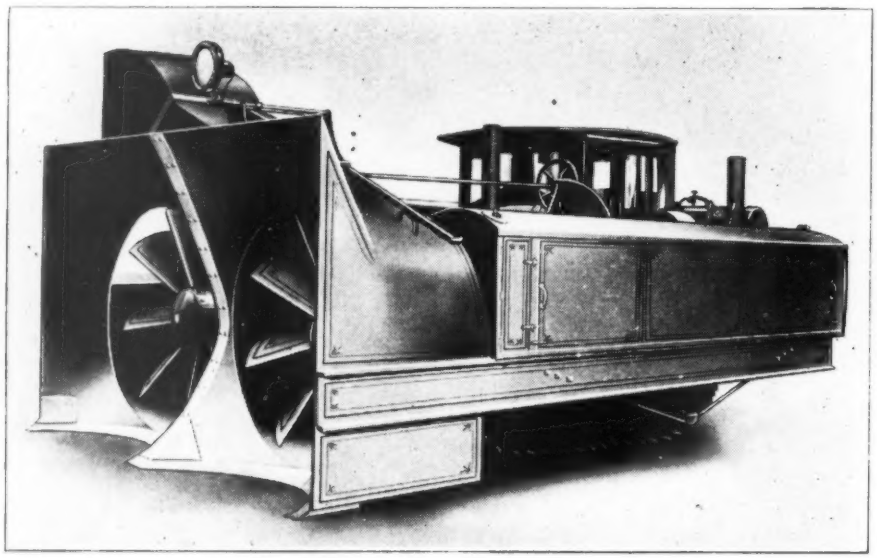
A Type B Bucyrus-Erie Shovel at Work Clearing Snow from a Street in Boston, Mass., and Loading It Into Motor Trucks



FWD Truck Equipped with "V" Type Plow for Municipal and Rural Snow Removal Work, or the Type Used by the Missouri State Highway Department



Cletrac Equipped With Snow King Rotary Plow



The Edwards Rotary Snow Plow

The Edwards Rotary Snow Plow at Work on a Heavy Drift

Cletrac With Rotary Plow.—A photograph on this page shows the Cletrac Model "100" equipped with a Snow King Rotary Plow and used last winter by the State Highway Department of Michigan. This is a very efficient outfit, particularly where the snow is heavy and deep drifts have formed. The Cleveland Tractor Company, Cleveland, O., also builds a complete line of Cletrac Crawler Tractors, consisting of four models, all of which are equally adaptable for winter use. Various snow plows have been adapted for each of these models so that the manufacturers are in a position to furnish the power requirement in almost any instance where a tractor can be used for keeping roads and city streets open during the winter season.

Edwards Rotary Snow Plow.—While primarily intended for rural snow removal work, the rotary snow plow will find occasional application in the municipal field. One rotary that has been reported is that manufactured by the C. D. Edwards Manufacturing Co., Inc., of Albert Lea, Minn. This rotary clears a strip 13 ft. wide in one trip and throws the snow clear of the pavement. The plow is built with two individual motors which furnish power for revolving the rotors. Both motors are equipped with electric starters and automatic governors, allowing the operator to give his full attention to the driving of the plow. The motive power supplied is the 10-ton Caterpillar tractor. While the plow will handle all normal obstructions, a shear pin has been provided in each rotor to prevent damage should fence posts, logs and other major obstructions be encountered. Because of the design, side-draft is said to be eliminated, and because the plow is mounted at the center of each track of the tractor, putting no weight on the tractor frame, there is no tendency to ride over the work. Depth of cut, it is said, can easily be controlled from the cab. The weight, including the tractor, is 38,000 lb., he length overall is 30 ft., the height overall is 12 ft., and exclusive of the tractor, the plow delivers 200 h.p. Equipment is standard automotive equipment, and ample fuel capacity is supplied.

New Adams Snow Plow.—J. D. Adams & Company of Indianapolis, Ind., have just announced a new snow plow for use on their motor graders—the No. 10 with McCormick-Deering Tractor and the No. 11 with "Caterpillar" 20 Tractor. This plow designed with the cooperation of the LaPlante-Choate Company, leading snow plow manufacturers, is of the same type successfully used on truck throughout the country by state and county highway departments. When lowered the plow rides on three caster wheels with a road clearance of about 1 in. The plow is very readily raised by the hand control in the operator's cab. Wings are optional, but are recommended.

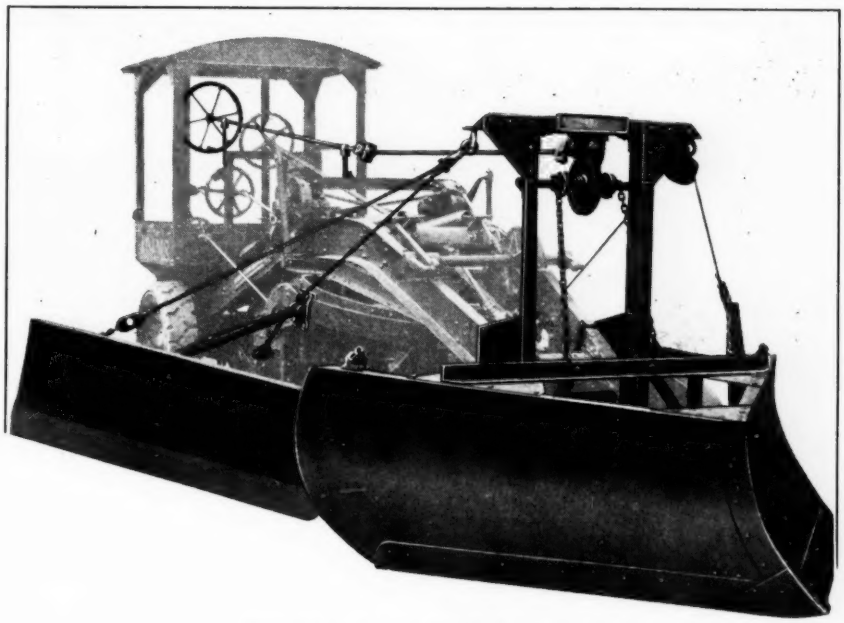
They are fully adjustable vertically and in and out to meet the various requirements encountered in snow removal.

The plow is said to be very strongly built throughout and well braced. The plow proper cuts to a width of 8½ ft. With wings the cut can be increased to 16 ft. The plow is 29 in. high in front and 33 in. at the rear. At any time during the winter it is desired to remove the snow plow from the grader temporarily it may be disconnected in a very short time, the upright lifting frame being left on the grader as it in no way interferes with the normal action or adjustment of the machine.

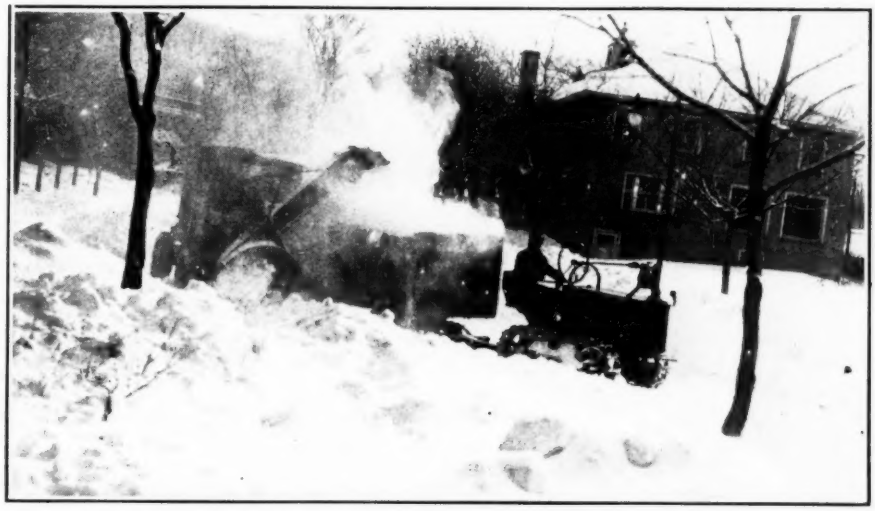
Caterpillar Tractors and Snow Plows.—As might have been noticed in the foregoing pages, a wide variety of snow removal equipment has been designed for use with the Caterpillar tractor, manufactured by the Caterpillar Tractor Co., San Leandro, California. The Caterpillar has been noted for stamina and power and general reliability, and it is these things that are of particular importance in any motive power for snow removal work, a service that is one of the most severe. Caterpillars have been found working with blade plows, "V" type plows, rotaries, and with scarifiers and other equipment for ice-breaking, both on municipal and rural work. Special small sidewalk plows have been developed for use with a light tractor for clearing sidewalks. Pratcically all plows are adjustable to leave a sleighing surface when desired.

Sometimes a drag is used, made of fitted timbers connected behind the plow, and clearing a 30-ft. strip. A cab mounted on the tractor provides sleeping accommodations in order that the plow can be kept working continuously night and day, with one operator sleeping in the cab while the other is at work. Other devices seen include the ice-breaking scarifier, cleated rollers for ice, elevating loaders of the bucket and belt types, grab buckets, skimmer scoops, special tractor loaders with snow buckets, power shovels, explosives, and pneumatic tools. A combination plow and loader has been developed, used in about the same manner as an elevating grader. Another new development is the adoption of one-man maintainers, powered with the 2-ton Caterpillar, for snow removal work. Special types of grousers and tracks are available to meet any special conditions that the Caterpillar may be called upon to encounter in snow removal work.

As to the cost of using tractor equipment, it is reported that Bangor, Me., in using the Caterpillar, has experienced costs of about $9.52 per mile, not including depreciation, insurance, or garage rent. This city was reported to have announced that it cost one-half as much to open 15 miles of pavement with horses as to maintain 102 miles with motorized equipment. The cost of motorized equipment all told was found



New Adams-LaPlant-Choate Snow Plow



Caterpillar 2-T with Snow Loader at Work in Montreal, Canada

Caterpillar 2-T with Russel Motor Patrol No. 4 Used in Lincoln Park, Chicago, Ill., to Keep Main Drive Open

Caterpillar 2-T with Killefer Snow Plow Operating in Portland, Ore.

Caterpillar 30 and Scarifier Used in Minneapolis, Minn.

The Warco Snow Plow Working with the Warco Grader

snow removal with horse-drawn equipment was said to have cost about $56.59 per mile. The City of Toronto, Canada, has been reported as experiencing a snow removal cost of from $26 to $72.50 per mile, using regular maintenance equipment as far as possible.

The Warco Snow Plow. — Designed for use with the Warco line of one man graders, the Warco snow plow is said to approximate $14.69 per mile, while to have proven to be a very efficient means of clearing streets and highways of snow.

Removing the scarifier from the grader, the plow is readily mounted in place of the scarifier. If the grader is not equipped with a scarifier the plow can be attached with no trouble by an unskilled mechanic in a short time, say the manufacturers.

The ordinary fall of snow can be cleared away quickly utilizing the plow only, it is said, but a heavy snow fall will require the use of the grader blade in addition to the plow. In employing both cutting edges the plow is raised and the blade lowered. When raised the plow clears the ground by 11 inches; this brings the highest point of the plow 41 inches above the ground line.

The Warco snow plow is said to be substantially built, and on account of its cheapness, low maintenance cost and one man operation, is claimed to be an economical means of keeping traffic moving during the winter months. The plow will increase the earning power of a grader, since the grader can be used during practically the entire year. The plows are manufactured by the W. A. Riddell Company, Bucyrus, Ohio.

Financing Sewage Disposal

Two bills of importance to Wisconsin cities will be submitted to the state legislature. The bills, which are sponsored by the League of Wisconsin Municipalities, are:

A measure permitting municipalities to create a fund for better sewage disposal by making a charge for sewage disposal.

A measure permitting municipalities to provide for a rival public utility to one already existing, if they consider the construction of such a utility preferable to securing the existing utility under condemnation proceedings, now permitted by law.

Proper Accounting Urged for City Utilities.—The report of the Municipal Securities Committee of the Investment Bankers' Association, of which John J. English of the William R. Compton Co. is chairman, published in the current bulletin of the association, strongly urges the use of proper accounting methods in determining earnings and value of municipally owned public utility properties. This applies primarily to such properties as are financed by the issuance of securities payable solely from the revenue derived from such systems.

How St. Louis Handles Minor Traffic Violations.—The city of St. Louis, Mo., has established a traffic violation bureau which aims to facilitate the handling of minor cases without the necessity of court action upon please of guilty.